ARCHIVES OF OPHTHALMOLOGY.

REPORT OF A CASE OF MELANO-SARCOMA OF THE LIMBUS IN AN EYE WITH NORMAL VISION, FOLLOWED BY ENUCLEATION.

By Dr. GEORGE HUSTON BELL,

ASSISTANT SURGEON, NEW YORK EYE AND EAR INFIRMARY, ETC.

(*With two figures on Text-plate XXI.*)

THE following case seems interesting and worthy of record, owing to the malignancy of the disease and the infrequency of its occurrence.

May 9, 1903, J. E. D., of Watertown, N. Y., was sent to me for examination and treatment by Dr. W. H. Holzapfell. The patient claims that the trouble first started in left eye, as a little vein, ten years ago. He has had headaches frequently, and every time one of these attacks came on it distended this blood-vessel in his eye. The black spot appeared as a pin-head point about six years ago and gradually increased to a black patch. About three years ago he developed epilepsy.

Family history negative and general health only fair.

Status Præsens.—A black neoplasm situated at the limbus in the temporal quadrant about 6*mm* in width and 10*mm* in length. It projected about 3*mm* from the natural surface of the globe, encroaching anteriorly 3*mm* on cornea and posteriorly about 3*mm* on scleral conjunctiva. The external rectus muscle was paralyzed, which gave him diplopia. The iris and fundus were normal and the vision was $\frac{20}{20}$ +. The paralysis of the external-rectus muscles had developed in the last six months and had remained constant. There was no glandular enlargement either in the parotid, cervical, or submaxillary region; but the pre-auricular glands on the left side were enlarged and could be readily felt.

Treatment.—The patient was advised to go to the New York Eye and Ear Infirmary immediately for treatment. He was admitted to the hospital on May 10, 1903, and a small portion of the tumor was removed and examined by the pathologist, who made the diagnosis of melano-sarcoma. The writer then explained the gravity of the disease and advised enucleation at once.

On May 15, 1903, I enucleated the eye and removed all the external-rectus muscle, which had been paralyzed. The healing after the operation was normal and uneventful. The eyeball was turned over to Dr. Geoge Sloan Dixon, the pathologist, to whom I am indebted for the microscopical examination which is as follows:

On May 9, 1903, a small piece of tissue was submitted from limbus of left eye of J. E. D., aged thirty-two years. Sections showed it to be alveolar melano-sarcoma. May 15, 1903, the eye was removed. The globe measured vertically 24; transversely 25.5; antero-posteriorly 25.75*mm.* The cornea measured 12.5 x 13.75*mm.*

When the globe was divided, it appeared to be normal, except for a small tumor at the limbus about 6 x 10*mm*, microscopically superficial; but sections showed a small amount of round-cell infiltration into the sclera, and the outer layers of the cornea were invaded by the growth to a limited extent. As the growth passed inward across the limbus, it lay wholly between corneal epithelium and Bowman's membrane, and in this situation was densely pigmented.

Diagnosis.—Alveolar melano-sarcoma.

The patient has been wearing an artificial eye, and has had no recurrence of the disease up to the present time, a year after the operation.

The origin of these neoplasms is generally conceded to be traumatism, or a pigmented patch at the sclero-corneal margin. Panas[1] thinks that "a great many melanotic tumors arising in this region owe their pigment to their situation near the uveal tract, or to hemorrhage, and should not be considered as sarcomatous in the true sense."

It is not always easy to tell whether the pigmented patches seen at the limbus are malignant or not; the only safe way is to excise a small piece for pathological examination. A large number of cases tabulated by Strouse[2] show that

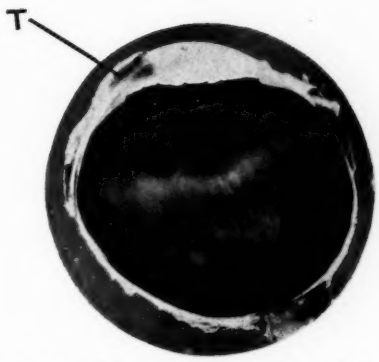

FIG. 1.—Melano-sarcoma of limbus. ×1.8.

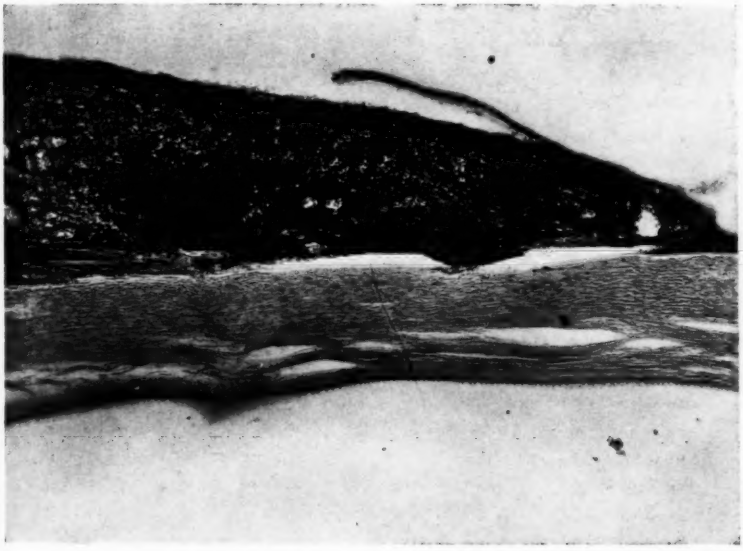

FIG. 2.—Melano-sarcoma of limbus. × 50. Showing tumor passing inward between corneal epithelium and Bowman's membrane. 1. Tumor. 2. Cornea propria. 3. Descemet's membrane. 4. Corneal epithelium. 5. Bowman's membrane.

the growth originated in these black or brown patches, and in many instances the growth began to develop after traumatism.

The question naturally arises as to whether it was wiser to remove the neoplasm and leave the eye intact, as vision was normal, or to enucleate.

My reasons for removing the eyeball were:

1st. That melano-sarcoma of the limbus being a true sarcoma does not differ from other forms of sarcoma in being highly malignant, except for the fact that it is situated upon the resisting cornea and sclera, which it sometimes invades, as it did in my case.

2d. That they are apt to recur and become disseminated.

3d. The quicker an eye is removed after the diagnosis has been made by the pathologist, the better the prospects of saving the life of the patient.

4th. Owing to the paralysis of the external rectus muscle which had recently developed, I was led to believe that the diseased condition was extending inward to the sclera, which was afterwards demonstrated by the pathologist.

5th. That the enlargement of the preauricular glands was to me another note of warning, showing that these growths are not always confined to the orbital tissues.

Remarks.—Of course there is a great deal to be said for and against the radical treatment. A few cases will be cited and some points presented in favor of the radical treatment. Verhoeff and Loring[1] in their exhaustive review of the literature on epibulbar sarcoma have this to say:

"The writers feel that epibulbar sarcomata must be considered highly malignant, judging by their tendency to recur and produce general metastases. That the immediate results are not always serious and suggest a relative benignancy, may be explained by the facts that these tumors are at first isolated on the conjunctiva, resting on sclera and cornea, both highly resistant to invasion. That the results after enucleation would be more favorable is natural on account of the more radical nature of the operation, and that there were some general metastases, even after

enucleation, certainly strengthens the argument in favor of the malignant nature of epibulbar sarcoma."

Kerschbaumer [4] reported a case of a woman aged fifty-eight; the tumor starting from a small spot near the limbus and extending from cornea to equator. Enucleation, and death in two and one half years from general metastases; melanotic. He also cites another case of a woman aged thirty-eight; tumor near the limbus, as large as a pea, starting from a small brown spot; after repeated abscissions the tumor returned, extending from the limbus backward into orbit. Exenteration, and no recurrence after five years.

Seiderer [5] reports two cases:

(*a*) A woman, aged fifty-eight, showed melano-sarcoma of bulbar conjunctiva of left eye, at limbus. Enucleation, and in two and one half years recurrence in lids and inner angle of orbit; exenteration of orbit; no recurrence after four years. Round and spindle cells; melanotic.

(*b*) A man sixty years old. Six years ago, small swelling at right external corneal margin was cauterized and no inflammation for two years. After this the tumor encroached from the limbus zone and covered the whole cornea. Exenteration of orbit and also pigeon-egg tumor of parotid gland taken out. The character was mixed pigmented and round-cell sarcoma. Two years later, the patient died from supposed metastases.

Addario [6] reports a case of melano-sarcoma in the anterior segment of the left eye, in a man aged eighty-five. The history from his wife was:

Duration about two years. In about six months it grew to the size of a seed; still indolent and almost colorless. The patient complained of no disturbance of vision; after this time it began to grow rapidly and presented dark stripes; ulceration and bleeding then followed. First seen at autopsy. All over the skin black spots were found, slightly raised, from the size of linseed to a quarter. Throughout the internal organs numerous melanotic masses were found, which were true secondary tumors. The tumor consisted of round spindle cells—sarcoma.

Fuchs[7] reports a case of epibulbar melano-sarcoma on the conjunctiva at the outer side of the cornea.

Abscission; seven years later patient returned, with same disease on inner side of cornea. Several abscissions and several recurrences. Glands in front of ear at lower jaw and anterior aspect of neck had become enlarged. Radical operation, consisting of exenteration of orbit and removal of all enlarged glands. Since then the woman has succumbed to an extension of the growth to the internal organs.

Mittendorf[8]—melano-sarcoma of conjunctiva of eyeball and of the cornea, in a woman, aged forty-six.

For less than a year, black tumor near the limbus. Abscission, and in six months multiple recurrences. Abscission, and again in two years recurrences. Pre-auricular glands and those of neck enlarged. Abscission. Recurrences after last operation in four weeks.

Mittendorf had hoped to save the eye and the life of the patient.

Weinbaum[9]—woman, aged forty.

Tumor at limbus, as large as a pea, beginning one year before as small brown spot. Also numerous brown spots throughout bulbar conjunctiva. Abscission and multiple recurrences. After two years, recurrence. Enucleation, followed in one year by recurrences in orbit and general metastases and death. Autopsy; tumors; melanotic sarcoma.

Gruening[10] reported a case of corneo-scleral sarcoma.

A small black tumor was removed from outer side of the left cornea, with two operations and two relapses. First seen by Gruening in February, 1902, when he had a large black nodular mass overlapping the outer side of the cornea. A number of flat, circular, reddish bodies stood out from the bulbar conjunctiva. Enucleation. Microscopic examination showed melano-sarcoma. Patient made a good recovery and wore an artificial eye in eight weeks. In May, leucosarcoma appeared in conjunctival

scar; excised. Four weeks later, tumor recurred. Exenteration; the lachrymal glands, conjunctiva, and tarsus of upper and lower lids were removed. No recurrence up to the present time.

CONCLUSIONS.

1. That melano-sarcoma of the limbus is of comparatively rare occurrence and highly malignant.

2. After reviewing the literature on the subject, I am forced to conclude that most cases of epibulbar sarcoma demand radical treatment just as soon as the diagnosis is confirmed by the pathologist.

3. The writer believes that it is not fair to jeopardize the life of the patient by a compromise in the treatment in the way of an abscission, for all the cases cited by me have proved that abscissions were of no avail. In forty-four cases of abscission that were followed, recurrences were known to have occurred in thirty-six of them.

4. That they do recur, sooner or later, when excised and are apt to produce general metastases.

5. That they can produce fatal metastases after abscission even when fairly small, is proven by Fuchs where the patient died from the extension of the growth to the internal organs.

6. After all is said and done, to my mind the radical treatment is by far the most conservative in the end.

I wish to express my great appreciation and indebtedness to Dr. George Sloan Dixon for the excellent micro-photographs illustrating this paper.

BIBLIOGRAPHY.

1. PANAS, in Swan M. Burnett's *Diseases of Conjunctiva and Sclera*. Norris and Oliver, vol. iii., 1898.

2. STROUSE. ARCHIVES OF OPHTHAL., xxvi., 1, 217, 1897. "Sarcoma of Corneal Limbus."

3. VERHOEFF and LORING. "A Case of Epibulbar Sarcoma, with Secondary Growths in Limbus and Sclera, and Invasion of the Choroid, Ciliary Body, and Iris." ARCHIVES OF OPHTHAL., xxxii., 2, 97, 1903.

4. KERSCHBAUMER. "Das Sarkom des Auges." Wiesbaden, 1900.

5. SEIDERER. "Casuistische Beiträge zur Kenntniss der præ-corneal Sarcoma." *Inaug. Dissert.*, Würzburg, 1895.

6. ADDARIO. "Sul un Caso di Melano-Sarcoma Episclerale." *Annali di Ottalm.*, xiv., 393, 1885.

7. FUCHS. "Epibulbar Melano-Sarcoma." *Text-Book of Ophthalmology* (Duane), 1898, p. 120, second edition.

8. MITTENDORF. "Melano-Sarcoma of Conjunctiva of the Eyeball and of the Cornea." *Transactions of American Ophthalmological Society*, vol. iv., 1885-87, p. 264.

9. WEINBAUM. "Beitrag zur Kenntniss der Sarkom-Erkrankung der Augenhäute. *Graefe's Archiv für Ophthal.*, xxxvii., 1. S., 184.

10. GRUENING. "Corneo-Scleral Sarcoma." Report of Meetings of Ophthalmological Section, N. Y. Academy of Medicine. ARCHIVES OF OPHTHAL., vol. xxxii., 174.

FUCHS'S PERIPHERIC ATROPHY OF THE OPTIC NERVES.

By Dr. K. KIRIBUCHI, Tokyo.

(*With five drawings on Plates III. and IV. of Vol. XXXIX., 1, of Archiv für Augenheilkunde, April, 1899.*)

Abridged Translation by Dr. Ward A. Holden.

In 1885, Fuchs discovered that in adults an atrophy of certain bundles of fibres in the optic nerves was found as a rule. The bundles affected by this atrophy, which could almost be considered physiological, lie immediately beneath the pial sheath, on the surface of the nerves, and also about the central vessels. The atrophy is always found together with the so-called peripheral septa, which appear chiefly in the anterior segment of the nerve, just beneath the pial sheath. Farther back the peripheral septa become less numerous, and 15*mm* behind the ball they are entirely wanting. Much farther back, in the intracranial portion of the nerve, peripheral septa appear again, but not so numerously nor in so typical a form as in the anterior segment of the nerve. The nerve bundles included between these peripheral septa and the pial sheath are the peripheric atrophied bundles. Here the fibres are wanting and there is only an empty network of neuroglia. In cross-section the atrophic bundles are arranged like detached portions of a larger bundle, the peripheral septum being reduced to a narrow vascular tract, or the atrophic fibres are in connection at but one point with the normal bundle, and from this point extend along the periphery.

Similar conditions are found in the bundles which lie about the connective-tissue tract accompanying the central vessels. Fuchs found also that in some optic nerves the outer portions of the larger bundles adjoining the pial sheath exhibited the same atrophy. In the new-born also he found the peripheral septa, though not so well defined as in the adult. He says further: "I believe that the atrophy described, which is essentially a pathological change, exists, as a rule, in all men." The cause of this atrophy was supposed to be a compression of the blood-vessels, or a mechanical or chemical injurious effect of the lymph. This is a general outline of the conditions found in the so-called Fuchs's atrophy.

Various explanations of the cause of this condition and various interpretations of it were offered by Samelsohn, Michel, Wagenmann, and Otto.

Can the condition be considered pathological? Before discussing this question I shall speak of the physiological structure of the connective-tissue septa in the optic nerve.

Numerous studies of normal optic nerves have shown me that in longitudinal sections through the nerve trunk there are from fourteen to twenty-eight well-marked longitudinal septa. These septa proceed in part from the lamina cribrosa, in part from the pial sheaths at different points, and extend backward, gradually nearing the middle of the nerve. Other more centrally lying longitudinal septa arise from the sheath about the central vessels. These longitudinal septa run almost parallel to the direction of the nerve and are connected by lateral branches. These are best developed in the anterior portion of the nerve from the lamina cribrosa back 10–15*mm* to the point of exit of the central vessels from the nerve.

Farther back the longitudinal septa diminish in number and in thickness, but in the portion of the nerve within the optic foramen they increase until they are almost as well marked as in the anterior segment.

The longitudinal septa that spring from the pial sheath are more numerous in the anterior segment of the nerve than in the posterior. The transverse septa spring partly from

the pial sheath, partly from the longitudinal septa; the former branch, unite with the others, and form a network in whose meshes the nerve bundles lie. In transverse sections, one sees in the network of transverse septa the irregularly round or polyhedral bundles of fibres. In transverse sections, the number of marked points of intersection are from fourteen to twenty-eight, equalling the number of longitudinal septa. From the larger septa, smaller ones pass into the nerve bundles and there divide further, sometimes terminating in a thickened free end within the bundle (Plates III.–IV., Fig. 4, *c*).

In the lamina cribrosa and immediately behind it are many elastic fibres, which become fewer in number as one passes backward, although they can be followed back as far as the connective-tissue septa extend—that is, nearly to the chiasm.

In the anterior segment, where there is the most excessive development of the septal system, there are to be found, besides the usual longitudinal septa, those that are called by Fuchs peripheric septa. These arise from the pial sheath, run more or less parallel with the other septa, and many tracts of connective tissue connect them with the pial sheath. Their distance from the sheath is noted by Fuchs as 0.03–0.06*mm*.

These peripheric septa serve chiefly as points of origin and attachment for the transverse septa. Between them and the sheath are spaces filled with neuroglia tissue which Fuchs regarded as atrophic nerve bundles. In serial transverse sections, a peripheric septum will be seen to be extensive, extending past several nerve bundles (Plates III.-IV., Fig. 3, *a*), and again reaching only part way through a bundle (Fig. 4, *a*), and again reduced to a single tract containing vessels (Fig. 2, *a'*). Where the peripheric septum runs quite near the pial sheath and is closely connected with the latter, one often sees in transverse sections a completely isolated space filled with glia tissue. Fuchs's atrophic bundles thus lie between the pial sheath and the peripheric septa (Fig. 3, *b*).

In the new-born infant and in the fœtus of eight or nine

months, I have found evidences of these peripheric septa and of Fuchs's atrophy.

In my opinion, the peripheric septa stand between the pial sheath and the longitudinal septa—that is, they are modified longitudinal septa which can be regarded as a portion of the pial sheath. They exist chiefly to furnish points of attachment for the numerous transverse septa (Plates III.-IV., Fig. 1, *a*, and Fig. 3, *a*). They are developed mainly in the anterior portion of the nerve because there numerous transverse septa exist.

In my opinion, the glia tissue between the peripheric septa and the pial sheath is nothing other than a glia mantle about the nerve that must exist physiologically in all persons, just as the brain and cord are covered with a thick mantle of glia tissue. The glia tissue does not represent the network left after the atrophy of nerve fibres previously present, as Fuchs believed, nor a defective development of medullary sheaths, as Michel believed. If one considers this glia mantle as physiological and not due to atrophy, well developed at one place and poorly developed at another, one can readily understand in all cases its form and its sharp limitation from the nerve bundles. The form of the peripheric glia mantle of the optic nerve is irregularly cylindrical. It is well developed in the anterior segment of the nerve, again in the portion of the nerve in the optic foramen, and again farther back above the chiasm and tracts (Fig. 5, *b*).

My thanks are due to Prof. Greeff for the kind interest he has taken in this investigation.

Explanation of the Figures.

Fig. 1.—Longitudinal section of the nerve 6–8*mm* behind the ball, from a woman of forty. Van Giesen stain. Leitz ob. 3, oc. 1.

aa.—Peripheric septum with *f*, the glia mantle, between it and the pial sheath.

b.—Connective-tissue transverse tracts arising from the peripheric septum.

c.—Connective-tissue transverse tracts connecting the peripheric septum with the pial sheath.

dd.—Longitudinal septa.

p.—Pial sheath.

Fig. 2.—Portion of a transverse section 3–4*mm* behind the ball, from a man of sixty-three. Weigert's medullary stain, carmine after-stain. Leitz ob. 6, oc. 1.

aa'.—Peripheric septa; *a'*, consisting only of a round vessel-bearing tract.

bb.—Peripheric glia mantle.

d.—Large blood-vessel in the pial sheath.

p.—Pial sheath.

Fig. 3.—Transverse section 4–5*mm* behind the ball, in a man of sixty-one. Weigert-carmine. Obj. 6, oc. 1.

a.—Peripheric septum.

b.—Peripheric glia mantle.

p.—Pial sheath.

Fig. 4.—From a man of thirty-four. Stain and magnification as in Fig. 3.

aa'.—Peripheric septa; *a'*, bordering but part of a large nerve bundle externally.

b.—Peripheric glia mantle.

c.—Transverse tracts ending in a knob in the middle of a fibre bundle.

p.—Pial sheath.

Fig. 5.—Transverse section of the tract in its middle portion. Weigert-carmine. Obj. 3, oc. 1.

a.—Nerve fibres.

b.—Glia mantle.

CLINICAL CONTRIBUTION TO THE STUDY OF THE INNERVATION OF THE IRIS.

By Dr. C. MAGNANI, Turin,
OPHTHALMIC SURGEON AT SMYRNA.

THE iris is under the government of two different innervations. One presides over reflex movements, the light reflex and the sensory reflex; the other over the reactions associated with either voluntary or involuntary movements, and comprises the accommodation synkinesis and the cerebral synkinesis. As Parsons (1) says, with the first of these we can include the palpebral reaction of Galassi (2) or Gifford (3) or of Westphal-Piltz (4) as the Germans, without reason, call it; and the second is better known as Hirnrindenreflex of Haab (5).

As concerns the reflex movements, we know almost exactly the efferent paths (6), which go from the nerve centres to the iris, and the experimentalists are almost in harmony as to the position of the centres in the encephalon and medulla. But the studies of the afferent paths of the light reflex are not much advanced. The fibres arising from all parts of the retina enter the optic nerve, but, at the present time, we are unable to state what fibres, the larger or the smaller, are devoted to the vision and what to the reflex. Although of its progress in the optic tracts and of its relations with the nuclei of the 3d pair, we know a little more, no one is able to determine the position of centres for associated movements, since the studies on this part are only beginning.

Prof. Angelucci, of Palermo, who in a private letter had the

kindness to describe to me his experiments on this point, before publishing in the *Encyclopédie française d'ophtalmologie*, thinks that the movements of the iris, of the accommodation, and of convergence are harmoniously connected but not inevitably associated, and that the isolated position of the three centres devoted to the three movements compels us to admit a logical separation also in the periphery. But when the ciliary nerves enter the eye we are almost unable to determine the isolated functions, and only the supposition of Angelucci (7), that the gangliar cells, described in the ciliary muscle by Müller in 1859, have probably a sympathetic function, gives us some light on the argument.

Therefore I think that clinical observation must help physiology with careful examinations of every change in the movements of the iris. Coppern (8) also advises this.

The case that I now describe gives some aid to the physiological studies of iris innervation.

H., boy, aged twenty, came to consult me in March, 1902, after receiving a contusion on the right eye. We noticed a great blurring of vision with mydriasis. The sight slowly improved, and at this time, R E V = $\frac{20}{200}$. Rejected all glasses. The pupil was large, about 7*mm*, not regularly round, but its shape slightly distended towards the lower and inner side, so that in this part, between the pupillary margin and the limbus, the iris seemed more contracted. In this part also the iris was tremulous, and on observing the lens with the ophthalmoscope it was seen that the iris could not lean on the lens, because this was displaced a little toward the vitreous. On the posterior surface of the lens, and only toward the inner part, there were small and numerous opacities, for the most part needle-shaped, and disposed like rays from the posterior pole of the lens to the equator. The vitreous was normal and the retina and choroid presented no alterations, except a red suffusion in the macular region.

The pupil presented no reaction to light, either directly or indirectly, but when the patient was compelled to look at approaching objects the convergence was normal and a great contraction of the right pupil was visible, the pupil remaining still always a little larger than the other, and the same difference

obtained when a drop of 1% eserine solution was instilled, which produced contraction of the sphincter.

I regret neglecting to search for the symptom of Galassi.

On account of the great blurring of vision and the opacities of the lens, the question whether the power of accommodation was partly retained or not could not be decided, either subjectively or objectively (by determining the refraction with the ophthalmoscope used for the erect image or for skiascopy).

Four weeks after, he came again, and with glass of − 1.25 D. the sight was improved to $\frac{8}{10}$.

As before, the curvature of the cornea presented no change; the red suffusion of the macular region had almost disappeared and no trace of any rupture of the surrounding parts was visible. Also the pupil began to contract to light directly and indirectly.

The patient was a very intelligent man who presented no symptoms of hysteria or easy auto-suggestion; he did not drink excessively and was no smoker. He only presented a tremor intentionalis of the hands, but without any other symptoms of derangement of the nervous system. It was rather a form of essential hereditary tremor.

He came again in this year: R E V = $\frac{8}{10}$ with glass + 1.25 D. Pupil a little more dilated than the other; reacts to light directly and indirectly and to convergence. Macular region normal, iris tremulous and contracted in the same place as before, lens a little displaced towards the vitreous, with numerous opacities at the same place but rather in the form of spots than needle-shaped.

It was not possible for me to produce the palpebral reaction. Rather it seemed that the closure of the lids produced a dilatation of the pupil.

If we look in the literature we can find many other cases on which this sort of mydriasis was also noticed without any traumatism or concomitant affection of the nervous system.

Caspar (9), Seggel (10). and Lyder Borthen (11) observed many of these cases, and Leszynsky (12) with Bach (13) thought that they were caused by central degeneration of the oculo-motor nerve, especially of the nuclei and radicular fibres, and most often were due to syphilis. But Peters (14) reported a series of cases on which there was anisocoria without any other appearance of nervous disease. More often there

were other diseases, as pulmonary tuberculosis, erythema nodosum, articular rheumatism, gastric dilatation, etc. But my patient, as I have said, had never had syphilis.

Reymond (15), in two cases of fracture of the orbital arch and part of the base, observed, with other symptoms of sympathetic paralysis, unilateral loss of the direct pupillary light reflex, while there was persistence of the reflex when the light fell on the healthy eye and when convergence and accommodation were performed.

But returning to my case, which is slightly different from the cases of De Schweinitz (16) and Duane (17), we are unable to attribute the cause of mydriasis simply to a fine rupture of sphincter, as Duane did, because the iris acted during convergence, and for the same reason the idea of paralysis of the oculomotor nerve-endings, as De Schweinitz thought, could not be entertained.

It would rather have seemed a case of what is called essential mydriasis, if there was not a reaction of the iris to the convergence.

Here are in question the first centrifugal or centripetal paths of the retina, the iris, and the lenticular ganglion, that Bach, Angelucci, and Lodato pointed out to be a constrictor centre of the iris.

But the ganglion is too deeply situated and protected, and although the retina presented in the posterior pole of the eyeball a red suffusion, nevertheless the failure of indirect light reaction, as in the cases of Reymond, shows that interruption was not in the afferent fibres.

In the cases of Duane and De Schweinitz, there was no doubt that the lesion was a laceration of the sphincter of the iris. In the case of Reymond, the interruption was probably in the afferent paths. In my case, on the contrary, it must be also in the iris, but not in the muscles, rather in its nerves.

Remembering the hypothesis of Angelucci on the ganglion which Müller described in the ciliary muscle, we are compelled to admit, that the contusion has injured these gangliar cells, and therefore this form of mydriasis would be similar to the paradoxical pupillary dilatation of Langen-

dorff, and the same that occurs in the extirpation of the superior cervical ganglion, of which Lodato has given lately (18) an exhaustive explanation.

Indeed if we believe what the patient said, the mydriasis was manifested immediately after the accident, a fact that would not entirely confirm our explanation (which is the same as Angelucci's, to whom I described the case), because the paradoxical dilatation manifests itself only after many hours.

Besides, not infrequently there are cases of contusion of the eyeball in which the pupil is contracted instead of dilated, as in a case that I had under observation this year, with perforating wound in the inner margin of the cornea of the right eye. The anterior chamber seemed normally deep, and the pupil was contracted, in the form of a pear, because one part was drawn into the wound.

Being far away from town and having no eserine or pilocarpine, I was obliged to leave the pupil as it was till the following day, when I remarked that the pupil was still contracted, but round in form, and the inner synechia had disappeared. The contusion was not severe, and there was no alteration in the deep parts of the eye.

This is confirmed in the experiences of Berlin (19) and Bach (20), who observed that small traumatisms, gradually increasing in force, produce at first miosis for two minutes and afterwards mydriasis.

Bach, in microscopical examination of the iris and ciliary body, found only dilatation of the vessels, but paid less attention to this region than he did to the retina, since he was specially bent on studying the nature of commotio retinæ.

Be the explanation what it may, from the present viewpoint of science we cannot yet see clearly. However, I thought it useful to bring the case to the notice of colleagues, in the hope that they would pay attention to this subject of the complex movements of the iris.

1. *The Lancet*, April 23, 1904. "On the Neurology of Vision."

2. *Bollettino della Società Lancisiana degli Ospedali di Roma*, anno vii., fasc. 4, 1887; *ibidem*, anno viii., fasc. 2.

3. ARCHIVES OF OPHTHALMOLOGY, 1895, p. 402; *ibid.*, 1900, p. 191.

4. *Neurologisches Centralblatt*, 1899, fasc. iv. and vi.

5. Festschr. z. Feier des 50 J. Doktor-Jubiläums der Hr. v. Naegeli und v. Kölliker.

6. ANGELUCCI (vide N. 7) thinks that the ophthalmic branches of Willis have no fibres for constriction or dilatation of the iris, the movements being only under the influence of the sympathetic and common oculomotor nerve.

BACH (*Zeitschrift f. Augenheilkunde*, 2 H., 1904), on the contrary, maintains that the sympathetic acts only on the vessels of the iris, and that the dilator muscle is innervated from the long ciliary nerves, branches of V. pair.

BERNHEIMER (*v. Gräfe's Arch. f. Ophth.*, 1898, vol. xlvi.) and ANGELUCCI think that the nucleus of Edinger and Westphal, adjoining the nucleus of the common oculomotor nerve, is a nucleus for irido-constriction, but Angelucci did not know whether it influences so much the photometric reflex as the convergence.

On the contrary, BACH, drawing his conclusions from clinical cases and from experiments on animals, with total crossing of optic nerves, maintains that Edinger-Westphal's nucleus is not an iris constrictor at all, and that, as shown by decapitation of animals, there is in the medulla oblongata an inhibitory centre of the pupillary reflex.

7. "Ricerche sul meccanismo del movimento pupillare, etc." *Arch. d'Oftalmologia*, vol. vii., 1899–1900, p. 297.

8. "L'exploration de la pupille." *Arch. d'ophtalmologie*, 1903, p. 86.

9. "Ein Fall von einseitiger reflektorischer Pupillenstarre." *Arch. f. Augenh.*, xxxii., p. 291.

10. *Ibid.*, xxxi., p. 63.

11. "Die topisch-diagnostischen Verhältnisse bei einseitiger isol. reflekt. Pupillenstarre." *Klin. Monatsbl. f. Augenheilk.*, 1896.

12. "Unilateral Loss of the Pupillary Light Reflex." *N. Y. Med. Jour.*, 1898.

13. "Exper. u. path.-anat. Untersuch. über die Pupillarreflexbahnen." *Sitzungsbericht d. phys. med. Gesellsch. zu Würzburg.*

14. *Ueber Pupillendifferenz im Anschluss an eine Erkrankung der Augen und des Nervensystems*, Bonn, 1894.

15. *Annali di Oftalmologia*, fasc. 4, 1879.

16. *Ophth. Record*, May, 1901.

17. *Ibid.*, August, 1901.

18. "Sulla cosidetta dilatazione paradossale della pupilla." *Arch. d' Oftalm.*, vol. x., p. 25, 1902–1903.

19. *Klin. Monatsbl. f. Augenheilk.*, vol. xi., 1873, and *Berlin klin. Wochenschr.*, 1881.

20. "Experim. histol. Untersuch. ü. Contusio Bulbi." *v. Gräfe's Arch. f. Ophth.*, vol. xlvii., 1, 1898.

THE IMPORTANT CLINICAL POINTS IN PERIMETRY, WITH SPECIAL REFERENCE TO TRAUMATIC NEUROSIS.

By Dr. L. WOLFFBERG, Breslau.

Abridged Translation from *Archiv f. Augenheilkunde*, XLVII., 4 (June, 1903), by Dr. Ward A. Holden.

IT is evident that perimetric examinations can be of diagnostic value only when we have as accurate a knowledge as possible of the normal field of vision. But recent literature, including the latest text-books, shows that there are considerable gaps in this knowledge, and that, furthermore, the authors have not taken sufficiently into account known physiological facts in their interpretation of visual fields. The trouble is not so great when it is merely a matter of the general configuration of the field, but the confusion begins when the color fields are considered. It therefore appears to me desirable to discuss the points of clinical importance somewhat in detail.

Let us begin with the limits of the field. What are the normal limits of the field? The designation "normal" requires consideration. We find in literature three sorts of normal limits. Generally normal is taken to be the average limit. Förster, however, adopted certain minimum limits,[1] and I adopted maximum limits, and offered corresponding schemata of the visual field for clinical work.[2] It should not cause surprise that both Förster's and my own schemata are almost identical, for maximum observed by

[1] Heidelberg, *Ophth. Gesellschaft*, 1883.
[2] *Graefe's Archiv*, xxxi., 1, 1885.

me is regarded as the minimum for a field which is to be considered normal. The designation "normal" is understood in the same sense by each of us.

To me it seems utterly unscientific to judge of the ability of an individual by comparing it with the average ability. In order to refine the diagnosis, we must expect *a priori* every person to be capable of the maximum accomplishment, and then we must seek to discover the reasons for any slight failure to reach the maximum. Instead of accumulating the results of observations on children, adults, and the aged, with hyperopic or myopic eyes, with wide or narrow pupils, with prominent or deep-set eyes, and striking an average from all these, it is better to seek for the person whose field is the largest and then discover the reasons for a smaller field in others. Otherwise we shall again enter the era of the supranormal, as we did to our confusion in the determining of acuteness of vision. For a long time we regarded Snellen $\frac{6}{6}$ as normal vision, and overlooked the fact that, notwithstanding $V = \frac{6}{6}$, there might be anomalies of refraction, opacities of the media, and even incipient disturbances in the neuroptic apparatus.[1]

He who has vision $= \frac{6}{6}$ may doubtless have had formerly $V = \frac{6}{5}$. Since his vision has diminished, can we regard his $\frac{6}{6}$ as normal?

The designation "maximum" is not to be used without reservation. If we had determined the maximum temporal extent of the field as 100°, and then found it in a new case to be 105°, we should not designate this case as supranormal and let the matter drop. The reasons for the difference should be carefully sought for, and if in the given case we could discover perhaps that the width of the pupil and its relation to the margin of the cornea were responsible for the difference, we would have satisfied our scientific conscience.

We know that the prominence of the nose, brow, or cheek may be responsible for individual variations in the field

[1] *Cf.* my paper on the diagnostic value of the functional examination of the eye, *Beiträge z. Augenheilk.*, xvii., 1895.

upward, inward, and downward, and we must also know that the approach of the pupil to the cornea in accommodation renders the field larger. There are indeed minutiæ that, with the unavoidable errors of clinical examinations are of no diagnostic importance; they place in a proper light, however, our contention that only the best deserves the designation "normal."

Is a field normal when it possesses Förster's or my maximum limits? Indeed not.

We come now to the gaps mentioned at the beginning. Even when we find, in determining the outer limits of the field, that the white test object, moved from the periphery toward the centre, everywhere increases in brightness, and at no point—the blind spot excepted—appears less distinct, we are not justified in calling the field normal. A dark cloud in the sky may cause an entirely different field to be found. The field that we considered normal may with reduced illumination exhibit narrowing of its limits or scattered scotomata (idiopathic hemeralopia or disseminated choroiditis).

In order to fill this gap, Förster invented his photometer, which indeed will often prevent one from judging wrongly an apparently normal field. The same information can be obtained by a methodical reduction of the illumination while the perimetric examination is made.

In 1883 and 1884 while assistant to Sattler in Erlangen, I made up a tissue-paper arrangement for the window frame so that the illumination of the perimeter could be varied in a manner photometrically measurable. A field obtained under ordinary illumination could be controlled by any desired degree of reduced illumination, and this led to a number of new observations, the fundamental principle of which may be stated as follows: A visual field found to be normal in ordinary daylight must, under reduced illumination, while the chalk fixation-point remains visible, suffer not the slightest change in its outer limits and normal continuity. I grant that this encroaches upon the field of the light-sense tests, but it seems to me proper to retain it here since little attention has been paid to it in treatises on photometry.

Naturally, other clinicians have determined the field of vision with reduced illumination and have commended the method, but no one has advanced the above proposition, nor has any one undertaken the numerical measurement of daylight for this purpose.

Accidentally I discovered a curious symptom in cases of choked disk with this photometric perimetry, namely, a pronounced hyperæsthesia retinæ. The field, contracted 20–50° in ordinary daylight, reached its normal limits when the illumination was reduced. At the same time, the 10*mm* quadrants of my color apparatus were promptly recognized, while in the bright light they were confused.

To take the place of the photometric tissue-paper apparatus, in practice I have used a test-card with blue letters on a black ground. In the ordinary tests, variations of illumination affect the results but little, but with reduced illumination the blue letters soon cease to be recognizable. Only with bright light can one read $\frac{6}{6}$ and with illumination reduced until one can barely read Snellen $\frac{6}{6}$ one can read but $\frac{5}{30}$ on the black card with the blue letters. The window is shaded in any desired manner, and as the measure of the degree of illumination we record the acuteness of vision for the black card.

We shall see later how important is this peculiar dependence of perception of blue upon the general illumination, for the determination of the limits of the color fields.

We should not need to say much of the method of making perimetric examinations, if it had not appeared in recent years that one may become too skilled in the use of the perimeter—if we understand by "skilled" the ability to make the test with a patient of moderate intelligence thoroughly and quickly, and without fatiguing the patient.

Doubtless we would the more frequently overlook the "fatigue phenomenon," "which is said to be observed in cases of traumatic neurosis," the more skilfully we used the perimeter. It may therefore be recommended, after the examination has been made with ordinary skill, to undertake the sort of perimetry necessary to bring out the fatigue phenomenon. Let me not be misunderstood. It is not my

intention to discredit the painstaking and valuable investigations by Förster, Wilbrand, Koenig, v. Reuss, and others. In practice usually the suspicion of traumatic neurosis or some allied condition is entertained before examination is begun, and then naturally one seeks the displacement type, or the oscillation, spiral, or fatigue type, without bothering to determine the field in the customary manner. But I do not altogether agree with Schmidt-Rimpler that the concentric contraction produced in neurasthenic patients by fatiguing examinations is due to an ordinary relaxing of attention that can be corrected by energetic urging. In a certain sense, it is really a relaxation of attention, since in the opinion of most authors the pathological fatigue which develops is not in the retina but in the psychical centres. When one reads carefully v. Reuss's monograph,[1] one cannot avoid the conclusion that his observations, if they do not present anything absolutely new, still give a firmer base to the fatigue theory. v. Reuss's "fatigue spiral," as he states, has been described by Straub as "watch-spring field" in his text-book. Priority here plays no rôle, for even without the exhaustive studies of v. Reuss our neurologists would stand with Förster or Wilbrand, and "spiral" is simple and comprehensible. The manner in which the spiral is obtained is described by v. Reuss as follows: In making a perimetric examination, if one begins, for example, in the horizontal meridian of the left eye at 0 on the temporal side, and then examines at intervals of 15°, the examination is regarded as ended when one reaches 345°, and this final limiting-point is connected with the first at 0, completing the limits of the field of vision.

And if one is more conscientious and again examines the horizontal meridian, the point found is identical with the first, or differs from it so slightly that the difference can be neglected, and the same is true with tests in the other meridians. But if a fatigue-field develops, the point found in the horizontal meridian lies nearer the centre than in the first instance, and this is the case in meridians subsequently

[1] *Das Gesichtfeld bei functionellen Nervenleiden*, Vienna, Deuticke, 1902.

examined. On reaching o the third time, the limit of the field is still nearer the centre, and the contraction continues as the examination proceeds.

If all these points are joined by lines, one obtains a spiral. This I have termed the "fatigue-spiral."

v. Reuss was the first to furnish the experimental proof that the fatigue of the neurasthenic is chiefly a psychical fatigue, and that the idea of simple lack of attention should be given up. If during the examination of the first eye the second is kept closed so that its retina is at rest, the fatigue-spiral can be elicited at once when the second eye is uncovered. Since, according to v. Reuss, the nature of the fatigue is psychical, it should not excite surprise that fatigue is manifest also in direct vision. I call attention to this now, because we shall later discuss the fact that a slight fatigue of macular vision is a symptom of traumatic neurosis not less important than that of peripheric vision, and that each is inseparably connected with the other.

We have now arrived at a point where we can speak of the centre of the visual field as distinguished from the periphery, and then the question arises: Where does the centre stop and the periphery begin? Anatomically one might say that the centre included the macula lutea, while all the rest of the retina out to the ora serrata is periphery. Physiologically the matter is not so simple, and even Helmholtz as well as Hirschberg believed that the distinction might best be illustrated by an analogy.

"The entire field," said Helmholtz (p. 87), "corresponds to a drawing in which the important feature is carefully executed in detail, while the other parts are roughly sketched in, and the more roughly the farther they lie from the important feature." Hirschberg said: "The field of vision of a healthy eye in constant fixation may be compared to a painting in which a small central area corresponding to an angle of 1° is carefully done, while the rest is more and more roughly sketched as it approaches the periphery. Furthermore, in an area of 15–20° colors appear saturated, while farther from the centre one color after another fails until the periphery appears quite colorless and gray. The

maximum of acuteness of vision lies in an area no larger than 40′, corresponding to the 0.2*mm* linear extent of the fovea."

Every functional test must have a clinical purpose, and this holds good for the determination of excentric acuteness of vision.

The clinical purpose of tests of acuteness of vision is to furnish information in regard to the condition of the dioptric apparatus. The dioptric apparatus is normal when the refraction is emmetropic and the media are clear. The examination of the acuteness of vision and that of the dioptric apparatus are identical only when vision is normal and the eye emmetropic. If the acuteness of vision is reduced below the normal, the difficulty may be with the dioptric, the photochemical, or the neuroptic apparatus. It is evident that the determination of the acuteness of vision is of diagnostic value in the estimation of refraction only, but in order to find whether the periphery of the retina has its normal function, and thus to make differential diagnoses, we determine the limits of the fields for blue, red, and green. This latter gives us information in regard to the photochemical and neuroptic apparatus, and the tests are but little affected by the state of refraction. The perception of blue depends more upon the condition of the photochemical apparatus than upon the neuroptic, and the perception of red more upon the neuroptic than the photochemical. This is because the perception of blue decreases more rapidly than that of red, with reduction of the general illumination. This being taken for granted, every point in the field may be examined:

1. By determination of the acuteness of vision (dioptric apparatus).

2. By determination of the blue-light sense (photochemical apparatus).

3. By determination of the red-light sense (neuroptic apparatus).

For the fovea we determine the acuteness of vision in testing the refraction, and the tests of blue and red perception are easy. The tests of the acuteness of vision in the

periphery of the retina, as remarked above, cannot be made with the test of refraction, and these tests are of no value. Experience has shown that high degrees of refractive error do not particularly affect excentric vision, that in examining the field of vision it is sufficient to determine anomalies of the photochemical and neuroptic apparatus, that the examination of the red- and blue-light sense in the field is a sufficient functional test. We cannot determine for every degree of the field the distance at which red and blue can be seen, but as a summary substitute we determine the color limits, proceeding with the idea that, if red of 15*mm* diameter is recognized up to 70° on the temporal side, the same red will be seen more and more distinctly as it is carried from 70° toward the centre. The red and the blue field alone need be considered here, and the question arises: What are the normal color-limits? If we are to regard a particular color-limit as the standard, the intensity of the pigment must, according to Aubert, under all circumstances be taken into consideration. This depends upon:

1. Its spectral purity. (The so-called Heidelberg flower-papers are of great spectral purity, but they soon fade and I have found military cloths better.)

2. The visual angle. (A particular size must be determined upon. I use a patch 15*mm* in diameter.)

3. The surroundings. (We usually employ a black background. A lustreless and deep black cloth is best.)

4. Adaptation.

5. Intensity of general illumination.

The first four are constant and may be neglected. The fifth is variable.

There is but one way of obtaining clinically standard limits of the color fields, and that is to determine under diffuse daylight the maximum limits, and then to see what effect the diminution of general illumination exercises. The degree of diminution may be determined in the manner described above.

With the assistance of my tissue-paper apparatus I found out the following laws: The maximum color-limits contract, when the illumination is reduced to $\frac{3}{15}$ (see above),

gradually, but never more than 15° if the light sense is normal. The typical sequence—blue, red, green—is never lost. With further reduction of the illumination, the color limits contract, and finally green disappears, then red, then blue. This law then is that with normal light-sense the relation of the limits of the color fields remains constant with reduced illumination. We know that in disorders of the neuroptic apparatus the color fields contract concentrically and that the colors are lost in the order green, red, blue. The result is the same whether the sensibility of the neuroptic apparatus is reduced or whether the general illumination is reduced.

If in bright daylight we find the limit of the field normal and the color fields concentrically contracted, the cause of this contraction can lie only in a diminished sensibility of the neuroptic apparatus. In disturbances of the photochemical apparatus, we know that especially the perception of blue is reduced and the limit of the blue field may become contracted until it is within the limits of the red and the green fields.

If we compare a field with concentrically contracted color-limits with a normal field, we find that the color-blind zone between the outer limit and the blue limit is broader in the first case than in the second. The zone within this reaching to the red limit has perception of blue only, while normally red would be perceived here. This must be an alteration in the field due to a neuroptic disturbance, so long as the limits of the color fields are uniformly concentrically contracted and the sequence of the color limits remains normal. In severe disturbances of the neuroptic apparatus which lead to qualitative color-blindness, the green limit contracts earlier and more extensively than the red limit, so that complete green blindness may exist, while the red field is but slightly contracted and the blue scarcely at all. In cases in which there is a simple diminished perception of the entire neuroptic apparatus, as, for example, in traumatic neurosis, there will be uniform concentric contraction of all the color fields, with slight if any contraction of the field for white. This significance of the relations of the color fields to one another

and to the field for white holds good not only with reference to the entire field of vision, but also to every portion of the field and even to the fovea, although for the color limits of the fovea the distance at which the colored object can be seen must be substituted.

If we take a case in which only 15° of the central portion of the field remains, the relations of the color fields within this small area will furnish us the same information as if the field were complete. If all colors are still recognized and their limits are concentrically contracted, the excitability of the neuroptic apparatus is reduced in the field that remains and a further contraction of the field is to be expected. If the color limits coincide with the limits for white in the small field, the excitability is not diminished and the lesion is probably not progressive. We need not consider here all the possible relations of the fields, but what principally interests us is the concentric contraction of the color fields with normal limits for white—that is, the diminution of neuroptic excitability in the entire extent of the field.

This field is one of importance. What we understand by fatigue in traumatic neurosis is nothing other than a diminished neuroptic excitability, and the diagnosis we reach by finding various types of field—the displacement type and the like—can be reached also by determining the fact that there is concentric contraction of the color fields. I have studied these cases in the last ten years and, together with Dr. C. S. Freund, the neurologist, have taken a number of such fields. Even more important than the condition of the fields in general seems to be the fact brought out that every part of the field, even that corresponding to the fovea, is affected similarly. The reduction of excitability in the fovea can be made out with the tests of color perception in the distance. In practice it is much simpler to determine the macular diminution than to take the field with the perimeter, for fatigue of the macula is an evidence of fatigue of the entire field.

The following case of traumatic neurosis may be cited.

V normal in each eye. A red spot *2mm* in diameter and a blue spot *7mm* in diameter recognized at 4 or 4.5*m*. My tables

show this to be a reduced color-perception when the acuteness of vision is normal, and this finding alone would suffice for a diagnosis of traumatic neurosis. The perimetric control is naturally of scientific interest, although in fact it is no more than a control. In bright daylight the patient had a fairly normal field, but the color fields were concentrically contracted 20–30°. v. Reuss's fatigue-spiral could readily be made out as well with white as with blue. The displacement type also could be demonstrated, and in all my other cases of traumatic neurosis as well as in this, the displacement and the fatigue-types could be shown, as well as the concentric contraction of the color fields.

We should not neglect to mention the fact that the abnormal fatigue in these cases is sometimes preceded by a condition of abnormal excitability (*cf.* Freund on "Optic Hyperæsthesia of Cerebral Origin." *Neurolog. Centralbl.*, 1892, 17). I have seen cases in which red *2mm* and blue *7mm* were recognized as far as 15*m*, and in ordinary illumination the limits of the color fields almost coincided with the normal limits for white. Under further observation there was a gradual transition to the state of abnormal fatigue.

In conclusion I beg to recapitulate the important points considered.

1. A visual field that is found to be normal in bright daylight should not suffer the slightest change in limits or continuity when the illumination is reduced. This holds good up to the degree of reduction of the illumination at which the fixation-object ceases to be visible.

2. In every visual process of the unmoved eye three functions are concerned to a greater or less degree, namely, the dioptric, the photochemical, and the neuroptic.

3. The influence of the dioptric apparatus is recognized by the tests of vision employed in determining the refraction.

The influence of the photochemical apparatus is recognized by tests in diminished illumination.

The influence of the neuroptic apparatus is recognized on the one hand by exclusion after tests of the other functions, and on the other by a peculiar condition of the color sense.

4. The dioptric apparatus is of diagnostic value for the

macula only, since errors of refraction can be corrected practically for it alone.

For examining the photochemical apparatus blue pigments are best, since blue disappears first when the illumination is reduced, and since it is lost last in disturbances of the neuroptic apparatus.

For examining the neuroptic apparatus red objects are best, since the perception of red suffers quickly in cases of reduced excitability of the neuroptic apparatus, and since it is recognized better than blue in cases of disturbance of the photochemical apparatus.

5. What has here been said in regard to the influence of the three sorts of apparatus upon the visual act and their tests holds good not only for the macula but also for any particular portion of the field and for the field as a whole.

6. The limits of the color fields can be considered normal in a given case only when the degree of illumination is known. According to Donders and Landolt, the test is wrongly carried out if the limits of the color fields do not approach the limits for white.

7. The color limits contract concentrically as the illumination is reduced, but if the photochemical and the neuroptic apparatuses are normal there will be no change from the normal sequence of the limits—blue, red, green. If the illumination is reduced sufficiently, green disappears, then red, then blue, and colors are no longer recognized.

8. A field taken in ordinary daylight, which in its limits for white and colors corresponds to those obtained with a normal eye in diminished illumination, is typical of diminished excitability of the neuroptic apparatus and of abnormal fatigue, thus of traumatic neurosis.

9. Traumatic neurosis consists in an abnormal fatigue not of the retina but of the neuroptic apparatus including its cerebral centres. The fatigue found in the field as a whole also exists for the macula and is shown by the condition of quantitative perception of color.

10. Anomalies of the photochemical apparatus are revealed by the relation of the blue to the red limits. The preponderance of the latter over the former may not be

manifest at every point in the field and by every degree of illumination. The perception of red exceeds that of blue in the entire field only in cases of idiopathic hemeralopia, and even in such cases the symptoms can be made out only when the illumination is greatly reduced.

THE GONOCOCCUS THEORY.

By Dr. HERMANN URBAHN, of Berne.

Translated by Dr. Matthias Lanckton Foster, from *Arch. f. Augenheilk.*, Vol. XLIV., Supplementary Number (1901).

INTRACELLULAR, BISCUIT-SHAPED DIPLOCOCCI OF CONJUNCTIVITIS, STAINED BY GRAM'S METHOD. GROWTH OF GONOCOCCI IN ORDINARY NUTRITIVE MEDIA. THE VARIABLENESS OF GONOCOCCI.

ATTENTION has been called repeatedly to a micro-organism which closely resembles the gonococcus and like it excites a conjunctivitis. Krukenberg (1) obtained from a slight conjunctival catarrh a biscuit-shaped diplococcus massed in the cells, which took Gram's stain, did not grow in agar, but did grow in Loeffler's blood serum. For various reasons, chiefly because of its luxuriant growth in blood serum, he decided that this was not the gonococcus, but another micro-organism to which he gave the name pseudo-gonococcus. Morax (2) disputed this view and maintained his objections (3) in spite of Krukenberg's reply (4). I am now able to contribute to this subject a case of conjunctivitis from the private practice of Professor Pflüger.

July 15, 1900.—Boy, twelve years old, Russian, sent by physician with a diagnosis of gonorrhœal conjunctivitis. Both upper lids were much swollen, livid, and painful. There was an abundant secretion of thick, creamy, yellow pus. The red and puffy palpebral conjunctiva was not infiltrated, but was covered by a fairly firm membrane which was easily removed. The ocular conjunctiva was much swollen and injected without membrane

or infiltration. Cornea clear. No fever or special interference with the general condition.

The inflammation had begun several days before in the left eye and shortly afterward had involved the right. The left eye improved while the right became worse and caused a corneal ulcer, which, however, did not prove badly injurious. Nothing could be learned etiologically. The boy had no urethritis; the examination of his nurse by another physician was negative.

The clinical picture was not exactly characteristic. At first the secretion was decidedly blenorrhœic, yet there was lacking the infiltration of the conjunctiva which in some degree is always present in gonorrhœal conjunctivitis of adults. The easily removable membrane showed that it was a mixed case of gonorrhœal and pseudo-membranous conjunctivitis running a moderately severe course.

Microscopical examination revealed numerous biscuit-shaped diplococci singly and in great numbers in the secretion and also in the cells, up to the number of fifteen pairs in one cell, which were not stained by Gram's method and had the characteristic appearance of gonococci. This diagnosis was confirmed by an assistant in the dermatological clinic.

Tubes of glycerin agar thoroughly impregnated with the secretion contained after twenty-four hours numerous colonies apparently of the same biscuit-shaped diplococcus, which did not take Gram's stain. The colonies were grayish-white, with smooth edges, each about the size of the head of a pin, round, showing no difference between the margin and centre, of a uniformly homogeneous appearance, not granular. After twenty-four hours more staphylococci and xerosis bacilli appeared, and on the third day these had overgrown the entire culture. The first inoculation into glycerin agar, made at the end of twenty-four hours, proved negative, but further cultivation was possible after ascites fluid had been added. A pure culture was obtained by placing some of the forty-eight-hour culture in bouillon and transferring it thence to ascites agar. A second attempt to inoculate the cocci, the second generation in the ascites agar, into glycerin agar again failed, but, on the contrary, when a considerable quantity of the water of condensation

was transferred with them, beautiful, isolated, bright gray colonies appeared after thirty-six hours, which resembled the original ones except that they seemed rather more transparent. This may have been due to the carrying over of so much secretion. It was noticeable that on the second day the colonies acquired a greenish color, which after some days became diffused through the nutritive media. The cultures were at first short-lived, they dried up and were no longer inoculable after three days, but in the water of condensation of both ascites agar and glycerin agar they lived a week.

Other media successfully used were sugar agar, bouillon, gelatine, and horse serum. Inoculation of agar from potatoes was successful after twenty-four hours, but no colonies developed. Milk was not coagulated and remained alkaline. Bouillon became cloudy after twenty-four hours, and after several days acquired a greenish color. A moderate deposit of fine flakes was formed which could not be entirely dissolved by gentle shaking. In gelatine there was no growth in the temperature of the room and but little in that of the incubator. Puncture cultivation took place in sugar agar in the upper third without formation of gas. Growth was very luxuriant in blood serum, which was not liquefied. A large colony was developed which hung downward like a drop.

Great power of resistance to changes in the temperature was exhibited. Cultivations could be obtained from the condensation water of a serum culture which had stood for six days in the ordinary temperature of the room. A bouillon culture could endure a temperature of 45° for ten minutes, but the cocci were killed by a temperature of 50° C. These investigations were made after three months of artificial cultivation.

The demonstration of the pathogenic power was first undertaken after about four weeks. The first white mouse inoculated intraperitoneally with 2*ccm* of a bouillon culture died after three days. Remains of dead cocci were found in the slight peritoneal exudate, but not one well colored. There were no special organic changes. Four colonies of

diplococci not stained by Gram's method were obtained from the blood of the heart after thirty-six hours, which were no longer inoculable after two days. Subsequent inoculations of white mice were negative; in very young animals they produced only a very slight sickness at first. Guinea-pigs were not susceptible. Introduction of an agar culture into the conjunctival sac of rabbits, together with scarification of the conjunctiva, produced only a transient irritation which was probably traumatic. Inoculation of the cornea with a tattooing needle caused the cornea to become cloudy, with injection of the ocular conjunctiva, a slight chemosis, and some discharge, which in a few days spontaneously recovered. The presence of diplococci could not be demonstrated by the microscope or by cultures, though some dead cocci could be seen in the discharge taken from the cornea at the end of twenty-four hours. The other eye, which was irritated with an uninfected tattooing needle, was much less inflamed. Injection into the anterior chamber of a rabbit caused a severe iridocyclitis with a large hypopyon. The next day there was a spontaneous perforation of the eye and faintly colored diplococci were found in the hypopyon. Cultures showed staphylococci, but no diplococci. Cultures taken from the pus about the lens and from the purulent vitreous proved sterile, while under the microscope the same picture was seen as with the pus from the hypopyon. Repeated inoculations into the anterior chamber showed that more or less numerous colonies could be found after twenty-four hours and that after two days the cocci were dead. As time went on the course of the inflammation steadily grew milder. No other case of perforation occurred; at first the eyes became phthisical, but in the final experiments recovery was so complete that only a few posterior synechiæ remained to show that an inflammation had been present. Similar results were obtained by the injection of dead bouillon cultures into the anterior chamber. Intravenous injection of a rabbit was negative. The urethra of a dog was inoculated. After twenty-four hours the secretion, which had previously been slight, was increased and was found to contain many pus

corpuscles with bacilli, but no diplococci. Cultures also failed to demonstrate the presence of diplococci. On the next day the secretion was the same as before inoculation.

These experiments show that the cocci did not multiply in the bodies of the lower animals, but do not exclude a certain pathogenic power. The experiments were begun after four weeks of artificial propagation, and a diminution in the intensity of the inflammation produced was plainly to be seen, so it is probable that if inoculations had been made sooner different results would have been produced.

The writer inoculated his own mucous membranes with these results. No irritation of the urethra was caused by a dead agar or bouillon culture. Twelve hours after the introduction of living cocci the meatus was occluded, and there was a slight discharge from the anterior portion of the urethra, composed of mucus, epithelial cells, and pus corpuscles. Many little slender bacilli and diplococci decolorized by Gram's method were within the cells. Cultures showed only staphylococci and a bacillus like that of diphtheria. There were some strings of mucus in the urine at first, while the inguinal glands were slightly painful, and there was some ardor urinæ. In the course of the day all these symptoms disappeared. Later experiments in the urethra produced no results. Both the living and the dead cocci caused a certain amount of conjunctivitis. In the morning, twelve hours after inoculation, the lids were stuck together, but no diplococci could be found in the pus. Cultures showed staphylococci and xerosis bacilli, as well as diplococci, which could be decolorized by Gram's method, but unfortunately the last could not be isolated. The irritation of the conjunctiva produced mechanically was sufficiently less intense to warrant the conclusion that the conjunctiva was susceptible to a certain degree, but as the condition obtained was in no way comparable with the severe disease in the boy, we could not say that we certainly saw the cause of that conjunctivitis in the cultivated cocci.

The diplococci in the original slides presented such a typical picture that, according to views at present, they must be looked upon as the cause of the disease, but it is

undetermined whether they were the primary cause, or settled on mucous membrane altered by some other primary cause, and impressed a distinctive character upon the clinical picture. Colonies of these cocci alone were obtained at first from the original tubes, later the staphylococci and xerosis bacilli appeared. Therefore I believe I am right in identifying the cultivated cocci with those found under the microscope and in considering them to be the cause of the conjunctivitis. Too much weight must not be laid on the negative results of inoculation, for it is well known that the virulence of cocci lessens when they are grown in artificial media.

How shall they be classified?

Gonococci and the Jäger-Weichselbaum meningococci must first be considered. The latter, which were first described by Weichselbaum as the cause of epidemic cerebrospinal meningitis, are found also in the conjunctiva. There is very little agreement as to their biology. According to Weichselbaum (5) the intracellular, crescent-shaped cocci are not stained by Gram's method. They grow best in agar-agar (½ % NaCl, 1 % peptone, 1 % Rochelle salts, 1 % agar, 2 % gelatine), where they appear as fairly luxuriant, superficial, viscid vegetations which are gray in oblique illumination, grayish white by direct light. They grow very little in bouillon, and not at all in jellied hydrocele fluid or on potatoes. Mice were susceptible. Guinea-pigs and rabbits could also be killed, but without satisfactory proof of cocci.

Goldschmidt (6), whose work in the original I have been unable to obtain, described cocci decolorized like gonococci by Gram's method.

Fürbringer (7) found them in a man who had gonorrhœa and died of an intercurrent meningitis. They were studied by Kiefer (8), who also found their marked resemblance to gonococci under the microscope and considered their luxuriant growth in glycerin agar to be a fundamental distinction. All experiments on the lower animals failed, but the writer acquired a purulent rhinitis and found meningococci in the discharge. These fairly harmonious descriptions conflict

with the statements of many others as to growth, staining, and pathogenic power, and these differences are so marked that they can hardly be ascribed to variations in the preparation of the nutritive media, or of the stain, or to the varying susceptibility of animals. They can be explained better by the assumption that many micro-organisms have been described. Thus Jäger's and Weichselbaum's meningococci have nothing in common. Jäger's are stained by Gram's method, but even before decoloration they can be distinguished by their not very marked diplo-form and the presence of little chains from Weichselbaum's which always assume the typical position of diplococci and never form chains.

Hünermann (9) considers them related to the staphylococci, but not identical with them because of their intracellular position and because they liquefy gelatine more slowly.

Zupnik (10) found intracellular diplococci with single cocci uncertainly decolorized by Gram's method in fluid removed from a patient with meningitis. Bouillon and serum remained sterile ten days. Three varieties developed in agar, all of which grew in bouillon, whence the author concluded, I think erroneously, that none of the three was identical with the cocci in the meningitic fluid. It is possible that they became sufficiently accustomed to artificial media in the agar to enable the second generation to grow in bouillon. But he rightly holds it to be a variety distinct from Weichselbaum's, resembling that described by Pfaundler, which was very similar to the gonococcus, was taken from a meningitis, and did not grow in ordinary media. Pfaundler found the same coccus in aphthous stomatitis, in the throat of a child with meningitis, and in a diphtheritic throat where there were no diphtheria bacilli. Zupnik has found similar cocci in aphthæ of young children, and mentions as belonging to the same group diplococci resembling gonococci found in a pleural exudate. These also did not grow in the usual media.

Bonhof (11) obtained by puncture from an idiopathic cerebro-spinal meningitis diplococci which did not take

Gram's stain and did not grow in agar and glycerin agar. After autopsy colonies were obtained in agar, glycerin agar, and blood serum. They could be bred in blood serum and grew to the seventh generation in agar and bouillon.

Faber (12) easily cultivated in glycerin agar cocci which were decolorized by Gram's method and had no pathogenic power over animals.

Fränkel (13) described three cases of severe membranous conjunctivitis in children, clinically suggestive of diphtheria, from which he obtained biscuit-shaped diplococci which were decolorized by Gram's method. At first no colonies developed in serum or glycerin agar, but smearing the media with blood induced colonies to develop, and later glycerin agar alone sufficed. There was a little inclination to the formation of chains. Animals were not susceptible.

Haglund's cocci (14) came from a very severe conjunctivitis in a boy five months old. They grew in agar, glycerin agar, and bouillon, and showed marked changes in form during their artificial propagation. They were pathogenic for white mice even after two months. They were not decolorized by Gram's method. They coagulated milk in from four to six days, did not grow on potatoes, and sometimes grew in gelatine, but did not liquefy it.

There is a nearer approach to unanimity in regard to Neisser's gonococci, although some variations can be found described in literature. They are distinguished by their form, the way they swarm in the cells, and the negative result of Gram's stain. It is generally considered that they will not grow in the usual nutritive media, and that cocci which resemble them are not gonococci if they can be easily and luxuriantly propagated in such media. Now I have succeeded in propagating cocci which were beyond doubt gonococci in glycerin agar and other media in the following cases:

1. Bl. A case of ophthalmia neonatorum. Both father and mother had gonorrhœa. The clinical picture and microscopical appearance were typical. The biscuit-shaped diplococci, which refused Gram's stain, were massed in great swarms in the cells.

After twenty-four hours, numerous colonies appeared in ascites agar, which were of characteristic appearance, except that they seemed whiter, less transparent, and filamentous. Under the microscope they were typical gonococci. Glycerin agar inoculated with the secretion remained sterile. Twenty-four hours later, successful inoculations were made from the original culture into glycerin agar, in which propagation was maintained for thirty-five generations.

2. K. Urethral gonorrhœa. Impregnated tubes of ascites agar and glycerin agar failed to develop gonococci. Under the microscope gonococci were present, though not numerous.

3. M. Urethral gonorrhœa. Colonies appeared in ascites-agar after twenty-four hours, in glycerin agar after forty-eight hours. Pure cultures were not obtained as the first tubes were not clean. Some of this material was transferred to glycerin agar, and after thirty hours little colonies appeared where the material lay thickest. These were smoothed away, and after twenty-four hours more little colonies again appeared. Simultaneous transference to a fresh place failed though repeated many times and with fresh tubes. In my ascites-agar this stock did not thrive, but died out after three generations.

4. E. Urethral gonorrhœa. Positive growth in both ascites-agar and glycerin agar. Pure cultures were obtained from both by re-inoculation after twenty-four hours into ascites-agar, and the cocci which came from the original glycerin-agar stock could be successfully transferred back to glycerin agar, but the others could not. Four and five days later, further inoculations were made in glycerin agar and ascites-agar with negative results. On the contrary, some colonies sprang from the water of condensation, both in the same tubes, after stroking a place where the microscope showed that living cocci were no longer present, and also in glycerin agar, in which the cocci continued to grow. Again after some time there was difficulty in transferring a new supply to glycerin agar; they first took root after three applications to the same place and then only sparsely, but later on again did better.

5. U. Urethral gonorrhœa. Positive growth in glycerin agar and ascites-agar. After five days, the ascites-agar in the upper part of the tube had dried and the cocci were dead. In the glycerin agar, in which only a few colonies had developed, the cocci were not dead and were transferred to ascites-agar, where

they remained weak for several generations, but eventually recovered. In spite of repeated attempts they could never be made to grow again in glycerin agar.

6. Pr. Gonococci sent to me from Kral's laboratory in Prague. They were three days on the journey, *i.e.*, at the temperature of the room, and on the first day would take root in none of the media into which they were inoculated. After recovery in the original tubes they could be propagated in ascites-agar, whence they were transferred to glycerin agar with remarkably good success.

7. X. Urethral gonorrhœa. Positive results in ascites-agar and in two kinds of glycerin agar. After three days, transference to glycerin agar of varying concentration was successful only from ascites-agar. From this, further growth could be obtained only in ascites-agar, not in glycerin agar. On the contrary, from the last ascites-agar growth could be obtained in glycerin agar. From that time on, as a rule, the alternate generations would develop, but could not be propagated in glycerin agar. For the latter purpose it had to be re-introduced into ascites-agar. There was also no lasting growth in glycerin agar. From one of the original glycerin-agar tubes no transmission could ever be obtained from the other ; it could be made into ascites-agar alone, and the cocci behaved in the manner just described : they grew in glycerin agar, but the next generation had to be transferred to ascites-agar.

Experiments were also made with bouillon, gelatin, sugar agar, and jellied horse-blood serum. Although these have not yet been completed, some of the results may be mentioned. Stocks A, Bl, E, and Pr grew in bouillon, U and X did not. No cultures were obtained in gelatine at the temperature of the room, but in the incubator positive results were obtained from E and Pr which caused a slight superficial cloudiness. A similar cloudiness was obtained with Bl, but no successful inoculations were made from this though there were from E and Pr. The gelatine congealed again completely when chilled. Pr alone grew in sugar agar without ascites. With ascites added, E, Bl, and Pr grew, but only in the upper third of the puncture. Positive results were obtained in blood serum with A, Bl, and Pr. Much difficulty

was experienced with A and Bl; only after three inoculations in the same place were very small colonies produced which could be transferred twice only,—the third attempt never succeeded. On the contrary, Pr grew luxuriantly and propagation was easy and certain.

Growth was usually less luxuriant in glycerin agar than in ascites-agar, and this may account for some slight difference in the appearance of the cultures. Yet colonies 1.5 to 2*mm* in diameter sometimes could be seen in glycerin agar, particularly when it had a high degree of humidity. The color varied very much. Some were of a very delicate light gray, others of a dead white. E and Pr were brownish yellow in both media. Pr was so yellow at first that I feared contamination had happened.

This formation of coloring matter, associated with more luxuriant growth, appeared whenever the cocci passed from unfavorable to better conditions, would gradually diminish after they had remained in a good medium for two or three generations, and then reappear when they were transferred from a dry tube to a fresh one. Still, the whitest colonies were less white than those of staphylococcus albus, and the yellow of Pr was inferior to that of staphylococcus aureus; it was rather a marked brownish-yellow specially noticeable in the central portion.

All authors agree that the characteristics of colonies of gonococci are a lustre like that of moisture, transparency, formation of furrows, gradual transition of the brownish-yellow central part into the hyaline margin, which, with higher magnifying power is seen to be finely granular, notched margins, and little tendency for the separate colonies to coalesce. Steinschneider (15) mentions the arrangement of the isolated colonies in concentric rings. I believe that this appearance can often be seen in glycerin agar, usually on the third or fourth day. I have never seen them in young colonies. After some time, little nodules usually appear in the rings, which are analogous to the freshly sprouting colonies in those apparently dead, obtained after stroking a copious material over a large surface. A diffuse colony develops which lasts only a few days, when most of the cocci

die because of the exhaustion of the nutritive media, while single, isolated individuals survive and form dark colonies which are very refractive to light. These circumscribed nodules are often numerous and are not always confined to the peripheral part of the colony, so that the surface of the latter sometimes appears speckled like that of a blackberry. This is not the result of contamination; repeated examinations and inoculations revealed only one kind of cocci.

The growth in bouillon was best seen when the tubes were placed obliquely. Cloudy opacities developed on the surface and increased until they began to sink alongside the glass wall. This usually occurred on the second or third day, sometimes sooner. The bouillon, which had been clear hitherto, now quickly became muddy from partial dissolution of this cloud. Most of the mass sank in long, tenacious threads of mucus to the bottom, where it formed a ropy sediment which could be caused to mount upward in a spiral by a gentle whirling motion, although its adhesion to the glass would not be broken unless the motion was too violent. Long and energetic shaking divided the bouillon into almost perfectly clear below and densely turbid above. When allowed to rest, the sediment re-forms; made of separate loose flakes and threads, it is never granular. Sometimes the bouillon becomes cloudy much earlier and then the marked superficial cloud is absent. Gentle shaking could bring cloudinesses from the surface, but they were not so ropy, could be more easily dissolved, and the sediment rose from the bottom, on shaking, in fine loose threads, never in the form of a spiral. Perhaps this difference was due to the more or less luxuriant growth, as both pictures could be obtained from the same stock of gonococci. The tubes must be left alone for several days and guarded against all possible agitation.

In gelatine very faint superficial cloudy opacities were obtained, similar to those in bouillon. Puncture culture in sugar agar revealed nothing of special importance. In blood serum the colonies were very small, scarcely visible to the naked eye, adherent to the bottom, less lustrous than in agar. Pr grew very luxuriantly, in thick yellow colonies

with a large, lustrous drop at the lower end. The serum was not liquefied.

How are these results to be explained?

One would be justified in doubting whether the micro-organisms were gonococci, or diplococci which resembled gonococci in decolorizing with Gram's stain, but grew in agar in which gonococci cannot grow. It would be difficult to prove the contrary if this were a single observation of one case, but as several independent stocks gave similar results, the conclusion is necessary that in gonorrhœal diseases there are two or more varieties of cocci which cannot be distinguished by their outward appearance.

A probable theory may be based on the nutritive media, along which line other observations have been made. Turrò (16) cultivated gonococci in agar, gelatine, and bouillon to which acid peptone had been added. Thalmann (17) made his media useful by incomplete neutralization, and believed he had found that it was the action of the neutral and bibasic phosphates which gave nutrose its ability to make good material with agar and hog serum, contrary to the original idea of Wassermann, who introduced nutrose, that its ability was due to the fact that it prevented coagulation of serum albumin by heat, and so rendered it possible to sterilize serum without destroying the albumin, which is necessary for growth. The author himself adds that the agar prepared by him was not adapted for propagation, but he believed he could recommend his acid bouillon for differential diagnosis in doubtful cases. In the first place, it is not certain that all stocks will grow in bouillon; in the second, all the media I used were alkaline.

Bouillon is prepared in the bacteriological institute here in about the same manner as elsewhere. At first I used an agar nearly like Kiefer's, 2.5 % agar, 4 % peptone, 2 % glycerine. Kiefer's is difficult to prepare on account of the large amount of agar, 3.5 %, and of peptone 5 %, and cannot always be sufficiently clarified. Later I used 1.5 % agar, 1 % peptone, 2.5 % glycerine. All the media contained 5 % of salt. No differences were noted between the different supplies of agar, except that once a supply was bad and none of the

various micro-organisms inoculated into it would grow. Four weeks afterward, a dish containing some of this agar, which had been preserved accidentally, was successfully inoculated from a bouillon culture of stock A. Small colonies appeared in two and a half days and in time reached the size of *1mm.* Perhaps with the lapse of time the gonococci had lessened their demands so that they had become contented with very bad media.

Control experiments would be necessary to determine whether the nutritive media made here differed from those made elsewhere. In the dermatological clinic agar of different origin was used, but the gonococci were propagated in common glycerin agar. Possibly the peptone used has a determining influence.

We must now turn to the gonococci themselves for explanations of the facts that prolonged growth could not be obtained from all stocks in the agar used, and that positive results were obtained from bouillon, gelatine, and jellied blood-serum.

It is known that gonococci can grow in unpromising media if the secretion has been abundantly applied, and can be propagated for two, three, or four generations under certain conditions. Steinschneider and Schaefer (18) twice saw little colonies, only one of which was transmissible, spring up in common agar after stroking with sterile pus. But I propagated them for many more generations, though the growth became scanty. In stock M the cocci were propagated with difficulty through two generations in glycerin agar, but died on the third inoculation. In stock X only one generation could be obtained in glycerin agar. It should be mentioned here that sometimes in transference from ascites-agar to glycerin agar, and also from the latter to a tube of different origin and concentration, it is necessary to transfer a large quantity of the cocci. It is uncertain whether this is because there are only occasional germs which will be able to develop in the unaccustomed conditions, or because a material is set free by the death of many cocci which diffuses through the media and renders it serviceable, but the latter hypothesis is favored by the fact

that after one or more negative inoculations a subsequent one in the same place would prove successful. This conception is not negatived by the fact that micro-organisms in time produce a material poisonous to themselves, because Emmerich and Loew (19) could find this material only after a long development in large quantities. When the cocci have once taken root, little colonies appear in fresh places; they have become accustomed to the worst conditions. A certain power of adaptability must be granted the gonococci, just as to many other bacteria. De Christmas (20) observed that when he added a threefold quantity of ascites to his very concentrated bouillon the gonococci would not grow well at first, but after several impregnations grew luxuriantly. Scholtz (21) also says that nutritive media with rabbit serum may serve for old gonococci which have been cultivated artificially for a long time. This power of acclimatization seems to differ in different stocks. Stock A, which had repeatedly failed to grow in glycerin agar, grew in the fiftieth generation, Bl was ripe for agar in the second generation, E in the third, U refused to grow in common media, Pr grew even in jellied blood-serum. Stocks A, Bl, E, U, Pr, M, and K showed a great inconstancy, even in good media, which can be explained only by their individual peculiarities. The importance of chemical, mechanical, and thermic influences is of great interest, but has not yet been determined.

It also remains undetermined whether the virulence of all stocks is retained or not. Some negative inoculations have been reported. Wertheim (22) could not excite a urethritis with some gonococci three weeks old, while others twenty-seven days old were still virulent. Steinschneider (23) obtained only a slight urethral catarrh from a tenth generation. We know that their typical position within pus cells is a *conditio sine qua non* for virulent gonococci, but it is not certain that such is the case with gonococci whose virulence has been weakened or lost. It is also uncertain whether gonococci can lead a purely saprophytic existence. It might be expected that they would have lost their virulence in chronic gonorrhœa, yet Wertheim (24) produced urethral

gonorrhœa by means of gonococci from a chronic gonorrhœa. But this fact does not justify us in drawing general conclusions. Steinschneider cultivated either micro-organisms similar to gonococci as described by Noguès and Wassermann (25), Hogge (26), and others, or real gonococci which very quickly lost their virulence, but he threw no light on the question whether the culture would produce a different clinical picture. I will give some brief extracts from my own clinical histories, though they do not amount to much.

The ophthalmia neonatorum stock Bl, which grew in agar for two generations, did very well; the gonococci disappeared from the secretion in four days. In ten days the child was pronounced cured.

K, Male, fifty-four, first attack. Infection three weeks before, first symptoms after eight days. Anterior and posterior urethritis, prostatitis, epididymitis, and cystitis. Gonococci not found in the decreasing secretion after the twenty-second day. Treatment stopped after thirty-seven days. Gonococci reappeared three days later and soon disappeared again. At this time gonococci could be found by microscopical examination but not by culture. Fourteen days later there was no secretion and no gonococci. The prostatitis and epididymitis were well.

M, male, sixteen, first infection three weeks before. Secretion with abundant gonococci appeared on the tenth day. The cocci took root, but could be cultivated only to the third generation, in ascites-agar. Patient left the hospital before recovery.

E, thirty-five years old. First attack of gonorrhœa in Dec., 1899, which got well. Three months later there was a relapse, although he claimed that he had had no opportunity for another infection, from which he recovered in two weeks. Some weeks later another infection, recovery from which required five months. Present attack from a fresh infection. The first symptoms appeared on the eighth day. Entered hospital on the fourteenth day with epididymitis. Successful inoculations were made on the second day after entrance. The cocci grew permanently in agar after the third generation. No gonococci after eight days' treatment.

U, forty-three years old. Syphilis and gonorrhœa. Infection eight days before. Gonococci disappeared after nine days, reappeared on the fifteenth, and were not found after the

twenty-second. Inoculations were made on the first day. The cocci grew very well in ascites-agar, but not in glycerin agar.

X, male, twenty-six. Infection twelve days before. Gonococci disappeared completely after six days. No complications. The cocci grew well in ascites-agar, but never for more than one generation in glycerin agar.

Pr originated in a urethritis and had been cultivated in Kral's bacteriological laboratory for eight months. I do not know the particulars.

Nothing can be drawn from so few cases, but useful results may be obtained from the study of many cases and from the comparison of the results of different investigators in regard to gonococci taken from cases presenting different clinical pictures.

My culture experiments enabled me to institute comparisons between gonococci and other diplococci, although no distinction is possible under the microscope, and frequently all characteristics are lost in the culture.

A twelve-hour diplococcus colony in ascites-agar presents the same microscopic appearance as a twenty-four-hour gonococcus colony—transparent, slightly brownish yellow, a little granular, often with a punctiform centre and a notched margin. The transparency decreases with rapid and luxuriant growth, while the opposite is the case with gonococci. Later they again become more similar and show a more or less granular hyaline halo, through which run radiating, granular, dark brown bands. The beginning of this hyaline halo is marked by a fairly sharp line, concentric with the margin, at which the region of layer formation suddenly ceases, if the halo, as is usually the case later, is broken into layers at its base. The margin is less often notched, but this characteristic of gonococci is often absent, especially in glycerin agar. Common to both are the isolated fresh colonies which spontaneously shoot forth from those apparently dead, and the nodules in old colonies; they are more frequent and numerous with diplococci, and sometimes lie in a row like a string of pearls. Very often, as with gonococci, disks or rings may be seen enclosing the irregular or broken up centre. The macroscopical appearance of the colonies is

at first very similar. With rapid growth, the diplococcus colonies become thicker, larger, and more saturated. Gonococci are brownish yellow, diplococci greenish, sometimes as intensely so as a pyocyaneus culture, and the surrounding medium is similarly colored. It is not always the same; sometimes it seems to become lost through long artificial cultivation, then reappears from some cause unknown, and is again lost after several generations.

Kiefer has thus stated the differences between gonococci and meningococci. The latter grow faster than the former, show more tendency to be confluent, are less ropy in consistence, and form cloudy colonies which have the lustre of mother-of-pearl. Portions of these become in time of a smutty whitish-yellow opaque color. The microscopic picture of the separate colonies is more alike, but the structure is more compact. while the color, at first yellowish-brown, after some transformations again becomes clearer. This corresponds to Weichselbaum's description, as he found the colonies finely granular, with indented margins, yellowish-brown nucleus, and surrounded by an area increasingly transparent toward the outside. To this there is little to add. With gonococci the margins of the layers are fringed, with meningococci they are smooth, while the layers of the latter are on the whole more homogeneous and often lie close together as little round disks. Diplococci form rather plump layers with fringed margins. These differences are not of much importance; they are probably very variable and dependent on the media. Slight differences may be seen microscopically between the gono-, diplo-, and meningo-cocci. Near the well-stained individuals of the last, which do not differ in form from gonococci, can be seen others more or less faintly stained, which have lost their club shape and double position and lie in heaps of round disks. Later these melt into a homogeneous mass which forms a uniform light background on restaining the slide with saffranin, through which the young individuals are rendered prominent by contrast, surrounded by clear spaces which correspond to uncolored mucous sheaths. The same appearance is met with in old gonococcus colonies, but with the others it may

often be seen after twenty-four hours, at a time when gonococci are well formed and stained and show no signs of degeneration. This may be due to the more luxuriant growth of meningococci and diplococci where the multiplication is so rapid that the older cocci are forced away from the nutritive media by the younger and soon die, but this explanation is not satisfactory, for similar appearances are found at times with gonococci which grow luxuriantly, *e. g.*, Pr, as well as with meningo- and diplo-cocci. The size is very variable, from 0.5*mm* or less to 2*mm*.

Sometimes the growth in bouillon is somewhat different. Meningococci build superficial clouds in obliquely placed tubes, but they are much more delicate, not so tough and stringy, are more easily soluble, and often no sediment is present. The bouillon is then cloudy without flakes, and if a sediment is present it can be dissolved by gentle shaking. Diplococci seem to occupy an intermediate position. The superficial development is more marked, the slightly granular clouds are not easily dissolved, and a rather tough sediment is formed.

Kiefer believes a sure means of differentiation to be that meningococci will grow in glycerin agar while gonococci will not.

Steinschneider (15) says:

1. Serum is necessary for the cultivation of gonococci.

2. In order positively to diagnosticate a culture from any source as one of gonococci it must

a, not only resemble a pure culture of gonococci macroscopically, but

b, fail to grow if inoculated into simple agar, and

c, slides treated according to Gram's method must not take the stain.

Scholtz (21) says likewise. The identification of gonococci in culture is easy and certain. Besides the fairly characteristic viscous colonies in serum agar, the form and position of cocci in slides of cultures twenty to thirty hours old, and the appearance of degenerated forms in older cultures, we know to-day of no other diplococcus which is decolorized quickly and precisely the same on application

of Gram's method. Further, the growth in serum or ascites-agar ($\frac{1}{3}$) and other media for gonococci, with failure to grow in agar-agar, bouillon, and other common nutritive media for bacteria, is to the best of our knowledge characteristic of the gonococcus of Neisser.

Opposed to this view are the facts that there are intracellular, Gram-negative, biscuit-shaped cocci which do not grow in glycerin agar, according to Kister, Zupnik, Bonhof, and Krukenberg, while my experiments show that gonococci will grow not only in glycerin agar, but also in other common media, as found by Thalmann (17), Turrò (16), and Wertheim (22), who mentions in addition Bochhardt and Koch. Therefore I do not hesitate to pronounce inaccurate the statement that gonococci will not grow in common nutritive media, and to say that the result of an inoculation into glycerin agar can no longer be regarded as sufficient evidence for a differential diagnosis.

These results of culture accord with clinical observation. As there is a typical clinical picture which certainly depends on Neisser's gonococcus, so most stocks of gonococci will not grow in the common media, but demand their own peculiar nutritive media, at least in the first generation. But as sometimes the clinical picture is atypical in spite of the presence of gonococci, and as other micro-organisms can produce the same clinical picture, as proved by Groenouw, so atypical gonococci can be found which grow in agar, as well as other cocci which will not grow in agar but are not gonococci.

Is a differentiation possible?

Perhaps horse-blood serum may be of a certain value for this purpose. Meningococci thrive in this when they will not grow in agar, and even prefer it, while it seems to be the medium least acceptable to gonococci. But we must be cautious. The first generation may not grow in various media and yet the cocci gradually may become accustomed to them. Again the way seems to vary in which the different varieties can be brought to the same conditions of cultivation. Bonhof's cocci were propagated from the first in Loeffler's blood serum and would not grow in agar till the

seventh generation. Blood serum was successfully tried with the fourth generation of the Pr stock. Perhaps an earlier attempt would have succeeded, but the stocks A and Bl had caused it to be thought that gonococci would grow in agar before they would in serum, if they would grow in the latter at all.

As the results of Wertheim's experiments on animals (22) were for a long time not confirmed, animals have been considered insusceptible to gonococci, but the recent experiments of Wassermann (28), Nicolaysen (29), De Christmas (30), Grosz and Kraus (31), Hallé (32), Moltschanoff (33), Maslovski (34), and Scholtz (35) show that inoculated mice and guinea-pigs died and that cocci can be cultivated from the peritonitic exudate and the blood. If the animals lived over thirty hours they recovered and the cocci disappeared, so it is commonly thought that death was caused by intoxication. With meningococci it is different. Weichselbaum (5) found his cocci infectious for mice, less so for guinea-pigs and rabbits. He found the cocci multiplied in the bodies of the animals and killed a mouse by inoculation from the pleural exudate of a dead body. Here is a sharp distinction between gonococci and meningococci which is not mentioned by all authors. Kiefer's (8) cocci were neither toxic nor infectious. Bonhof (11) could not make mice very sick nor kill them by subcutaneous or intraperitoneal injections of 1*ccm*. Large intraperitoneal injections often quickly caused death and then cocci could be found in the blood, but after twenty-four hours they could not be found in blood or exudate. Guinea-pigs also were not wholly insusceptible to intraperitoneal injections. Faber (12) obtained an exudate from which cocci could be cultivated and the animals did not die. Other statements vary in the same way, so that the results from experiments on animals seem to be uncertain and unreliable.

Some years ago I undertook a number of investigations in regard to the antagonism between the pyocyaneus and gonococcus described by Schaefer (36) and Grosz and Kraus (31), and found that pyocyanei killed gonococci and rendered their development impossible. I repeated these ex-

periments, using my diplococci, and demonstrated that their development was likewise impossible in the presence of pyocyanei, although all the other cocci and bacilli at my command grew in the media, including Jäger's meningococcus. I did not have Weichselbaum's coccus at the time. Unfortunately I was unable to make any experiments to determine the exact dosage of pyocyaneus required. It is not surprising that the pyocyaneus should act more energetically on some bacteria than on others, and this fact may aid in making a proper classification.

Means for making a differential diagnosis are the more necessary because the clinical picture can help us so little. Other micro-organisms can play the part of gonococci to a certain extent, and it has been found that gonococci have pathogenic power in other tissues than the eye and genito-urinary organs. They have been found in endocarditis, arthritis, tendovaginitis, and abscesses, and have been proved to be such both by culture and by inoculation by Bordoni-Uffreduzzi (38), Colombini (39), Jundell (40), Ghon and Schlagenhaufer (41), and Wassermann (42). Such encroachments on the domain of other micro-organisms, which are probably not limited to the diseases mentioned, render the conditions complicated, and make differentiation difficult, especially when corresponding differences are detected in the cultures. But yet differentiation may be possible from the cultures alone if the investigation is made with the first generation, so that the bacteria will have no opportunity for adaptation. The growth of gonococci in glycerin agar is less luxuriant than in their proper media. This is particularly striking when there is a simultaneous transference of a glycerin-agar culture to glycerin agar and ascites-agar. Blood serum will never be refused by meningococci. They may not do well at first in glycerin agar, but they soon take root and usually grow more luxuriantly than gonococci. On the contrary, gonococci which will grow in serum never fail to grow in glycerin agar. Another point of distinction is to be obtained from the growth in bouillon. Meningococci form only delicate flakes and threads which are easily dissolved, or none at all, while gonococci form a

tough, tenacious sediment. It must be left to future researches to show whether these differences are distinctive and of lasting importance.

Were it not for the clinical symptoms my diplococci would be classed with meningococci rather than with gonococci. They would not grow at first in glycerin agar, but did in the fifth generation after the transference of plenty of the water of condensation. This might indicate gonococci, but inoculation into blood serum resulted immediately in a luxuriant growth. The green color has not hitherto been known with either meningo- or gono-cocci, so its presence favors neither. But the microscopical appearance of the colonies is that of gonococci. There are then certain points in which they agree with, and others in which they differ from, both meningo- and gono-cocci, so that I believe that these diplococci were not gonococci in the usual meaning of the term, nor meningococci in the sense used by Weichselbaum, but that they should be classed in the larger group known as meningococci, occupying a place of their own until it is possible to differentiate gonococci and meningococci. Possibly other varieties will be discovered, which will show that we are dealing here with a large, closely related group having many transitional forms. To determine this, bacteriological observations can have only a conditional value. A stock which has acquired permanent, originally foreign properties, should be placed in a condition corresponding to that from which it was first obtained, there be able to reproduce similar pathological changes, and then in recultivation exhibit the acquired characteristics as soon or sooner than before. I do not know whether such experiments can be undertaken successfully or not, but they do not seem to be impossible.

The ground I have taken in the Krukenberg-Morax question has been already stated. It is not well to speak merely of gonococci. The cocci were found to prosper in blood serum but not in agar. Unfortunately it is not stated whether later attempts were made to transfer them from the serum to agar or not. The good growth in serum and the negative result in agar led me to think they were meningococci, while perhaps they led Krukenberg to think

them gonococci and to give them the name pseudo-gonococci, a name which is not very suitable. In the first place all of his cocci were not decolorized by Gram's method, a point of great weight, for with all the differences which have been and may yet be found between the different stocks of gonococci, decolorization by Gram's method is the unconditional postulate for all. In the second place, it would be difficult to determine the dividing line between pseudo-gonococci on the one side and pseudo-meningococci on the other. A general collective name, such as biscuit-shaped cocci, would be better for the present; later the varieties might be assigned their proper places and names.

CONCLUSIONS.

1. Gonococci can grow in common nutritive media.

2. Glycerin agar alone is not sufficient for a differential diagnosis. Jellied blood-serum in connection with glycerin agar may suffice to distinguish gonococci from similar cocci, especially from the meningococci and nearly related varieties.

3. There appear to be bacteriological differences between various stocks of gonococci.

4. It remains to be determined whether these differences exist clinically. Extensive researches are desirable for this purpose.

5. Whatever other differences may be found, the three characteristics of form, staining, and relation to pus corpuscles must be possessed by all varieties of cocci to enable them to be classed as gonococci.

6. The varieties hitherto described seem to be related to meningococci.

7. Until it has been determined whether or not the gonococcus is a distinct variety with special characteristics, that name should be reserved for it alone, and the name pseudo-gonococcus be avoided.

LITERATURE.

1. KRUKENBERG, *Kl. Monatsbl. f. Augenh.*, 1899, p. 271.
2. MORAX, *Annales d'oculistique*, 1899, p. 394.
3. MORAX, *Kl. Monatsbl. f. Augenh.*, 1900, p. 439.

4. KRUKENBERG, *Kl. Monatsbl. f. Augenh.*, 1900, p. 259.
5. WEICHSELBAUM, *Fortschritte der Medicin*, 1887, Nos. 18 and 19.
6. GOLDSCHMIDT, *Centralbl. f. Bacteriol.*, 1887, p. 649.
7. FÜRBRINGER, *Deutsche med. Wochensch.*, 1896, p. 429.
8. KIEFER, *Berl. klin. Wochensch.*, 1896, p. 628.
9. HÜNERMANN, *Zeitsch. f. klin. Medicin*, 1898, p. 436.
10. ZUPNIK, *Deutsche med. Woch.*, 1899, Nos. 50 and 51.
11. BONHOF, *Münch. med. Wochensch.*, 1901, p. 89.
12. FABER, *Zeitschrift f. Hygiene*, 1900.
13. FRÄNKEL, *Zeitsch. f. Hygiene u. Infections-Krankheiten*, 1899.
14. HAGLUND, *Kl. Monatsbl. f. Augenh.*, 1900, Beilagehèft, p. 72.
15. STEINSCHNEIDER, *Wiener med. Wochensch.*, 1897, Nos. 13 and 14.
16. TURRÒ, *Centralbl. f. Bact.*, xvii., p. 865.
17. THALMANN, *Centralbl. f. Bact.*, 1900, p. 828.
18. STEINSCHNEIDER and SCHAEFER, *Berl. klin. Woch.*, 1895, No. 45.
19. EMMERICH and LOEW, *Zeitsch. f. Hygiene u. Infect.-Krankh.*, 1901.
20. DE CHRISTMAS, *Annales de l'institut Pasteur*, 1900, No. 5.
21. SCHOLTZ, *Arch. f. Dermatol. u. Syphilis*, 1899.
22. WERTHEIM, *Archiv f. Gynakologie*, 1892.
23. STEINSCHNEIDER, *Berl. klin. Woch.*, 1890, No. 24.
24. WERTHEIM, Transactions of the German Dermatological Society, 4th Congress.
25. NOGUÈS and WASSERMANN, *Centralbl. f. Bact.*, 1899, p. 336.
26. HOGGE, *Ann. d. mal. d. org. génito-urin.*, 1893, p. 281.
27. GROENOUW, *Arch. f. Ophth.*, lii., Heft 1.
28. WASSERMANN, *Berl. klin. Woch.*, 1897, No. 32.
29. NICOLAYSEN, *Centralbl. f. Bact.*, 1897.
30. See 20.
31. GROSZ and KRAUS, *Arch. f. Dermat. u. Syph.*, 1898.
32. HALLÉ, *Ann. de gyn. et d'obstet.*, 1899.
33. MOLTSCHANOFF, *Münch. med. Wochensch.*, 1899, No. 31.
34. MASLOVSKI, Reference in *Centralbl. f. Bact.*, 1900, p. 541.
35. See 21.
36. SCHAEFER, *Fortschritte der Medicin*, 1896, p. 161.
37. FRÄNKEL, *Hyg. Rundschau*, 1898, No. 7.
38. BORDONI-UFFREDUZZI, *Deutsche med. Woch.*, 1904, No. 22.
39. COLOMBINI, *Monatshefte f. prakt. Dermatol.*, Bd. xxi.
40. JUNDELL, *Arch. f. Dermat. u. Syphilis.*
41. GHON and SCHLAGENHAUFER, *Wiener klin. Wochensch.*, 1898.
42. WASSERMANN, *Münch. med. Wochensch.*, 1901, p. 298.
43. CANEVA, *La Rif. med.*, 1894, No. 25.
44. TOUTON, *Berl. klin. Woch.*, 1894, No 21.
45. VAN DEN BERGH, *Centralbl. f. Bact.*, 1896.

ABSTRACTS OF ARTICLES IN VOL. XXXIX. OF THE GERMAN EDITION, 1899, NOT PREVIOUSLY TRANSLATED.

By Dr. MATTHIAS LANCKTON FOSTER, New York.

I.—Sterilization of India Ink for Tattooing the Cornea.

By Dr. **OTTO v. SICHERER**, of Munich.

THE author considers dry sterilization at a temperature of 160° C. to be the best method, but as every physician is not possessed of the proper apparatus he recommends three other methods as efficient substitutes: 1, exposure for thirty minutes to a temperature of 60°; 2, exposure for fifteen minutes to a temperature of 98°; 3, repeated evaporations of the sterile water with which the ink is rubbed up.

II.—Refraction in Ancient Times. A Contribution to the History of Refraction Based on Literary Material Hitherto Unknown.

By Dr. **VINCENZ FUKALA**, of Vienna.

This article consists of quotations and comments under these headings:

1. Hippocrates on nearsightedness.

2. Aristotle gave the optical causes of presbyopia and myopia and was the first to suggest those names.

3. Albertus Magnus (1193–1280) ascribed myopia to a change of the position of the lens in the eye. Felix Plater (1536–1614) was of the same opinion.

4. Plemp (Vopiscus Fortunatus 1601–1671) recognized

from anatomical investigations that the lengthening of the axis was the true cause of myopia.

5. J. B. Morgagni (1681–1771) corrected the view held by Plater and Bonet (1602–1689), and demonstrated anatomically the lengthening of the eye in myopia.

6. Valsalva, Petit, and Morgagni gave as the cause of presbyopia a yellow discoloration and a hardening of the nucleus of the lens.

7. Morgagni gave a correct explanation of the process of accommodation.

8. Johann Janin described a second case of cataract operation in a young man who was highly myopic.

9. Spectacles and eyeglasses were very probably known several centuries before Christ.

III.—Further Contributions to the Ancient History of Refraction. Greek Theories Regarding Vision and Color.

By Dr. **VINCENZ FUKALA**, of Vienna.

A quotation from Theophrastus is added to the evidence adduced in the previous article to show the use of optical lenses among the ancients.

The references to Greek authors in regard to sight and color are very numerous. The first mentioned is Alkmaon of Crotona, who lived 520 B.C., and is referred to by Plato as the first to remove the eyes from dead animals for the purposes of study.

IV.—Remarks on Fukala's Refraction in Ancient Times.

By Dr. **ED. PERGENS**, of Brussels.

In this criticism it is held that Fukala's translation of the passage referred to in Hippocrates' writings is erroneous and that no reference is made therein to nearsightedness.

Regarding the statement that Janin in 1760 operated on the second case of cataract with myopia, Pergens says that Woolhouse stated in a letter to Le Brun in 1707 that

myopes who had been operated on for cataract did not need glasses. Higgs in 1755 couched the lens for myopia.

As to the use of glasses centuries before Christ, while it may have been possible, he claims that no proof is shown that they existed.

V.—Follicular Conjunctivitis and Trachoma.

By Dr. **O. WALTER**, of Odessa.

This is a long discussion whether these are two distinct diseases, or two manifestations of the same disease in different degrees of intensity. The opinions of many writers are cited, but the author does not arrive at a positive conclusion.

VI.—Operations to Improve the Mobility of Artificial Eyes. A New Prothesis of Special Form.

By Dr. **HUGO WOLFF**, of Berlin.

The artificial eye is attached to a hollow silver ball which is enclosed in Tenon's capsule after enucleation of the eye. It is claimed that the cornea of the prothesis is thus brought on the same level as that of the sound eye and that its movements are more lifelike than is usually the case.

VII.—Herpes Zoster Ophthalmicus.

By Dr. **R. D. COHN**, of San Francisco.

An extensive résumé of the literature on this subject, with a number of cases illustrative of certain causes and complications. In one case the patient described himself as having been subject during youth to five or six attacks a year resulting from fright. In two other cases patients who were taking arsenic for medical reasons were attacked by this disease, and in another case the disease appeared two days after the patient had narrowly escaped suffocation by carbonic-acid gas. The other cases illustrate such complications as serpiginous ulcer of the cornea, typical and atypical

superficial and deep punctate keratitis, iritis, iridocyclitis, optic neuritis, and paralysis of the extrinsic ocular muscles.

A comment on a sentence quoted from Ginsberg, in which he claimed that the latter had made an unconscious exaggeration, called forth a protest from the latter (VIII).

IX.—Hysterical Ptosis.

By Dr. **H. WILBRAND**, of Hamburg.

The patient was a sixteen-year-old, not well-developed girl, who had suffered from hysteria for several years. There was ptosis of both upper lids, but she was able partially to open the right eye by the action of the frontalis. When the left lid was raised by the observer, the left eye would be found to be directed inward and upward, and the patient could not change its position, so that there appeared to be total external ophthalmoplegia, while with the right eye the patient would follow the movements of the finger as far as the small palpebral aperture allowed, but when the lid was allowed to droop the left eyeball could be seen through the thin lid to move in perfectly normal association with the right. When the right upper lid was raised, the eye took its normal position. When both lids were lifted, both eyeballs remained fixed in a position of slight convergence, and the patient could not follow the movements of the finger with her eyes. The pupils were much contracted and reacted slowly to light. When told to open both eyes, the patient would contract her occipito-frontalis strongly and usually would lift only the right lid slightly. The right field was concentrically contracted on all sides to 30°. Small colored objects were not recognized. The left field was contracted on all sides to 40°. The field for blue and red was reduced to 20°. While under observation, an erythema appeared over the left eye and temple. Numerous hyperæsthetic zones were found on the body. The throat and conjunctival reflexes were absent; all the others were normal. The extremities were freely movable, both actively and passively. Strength was normal.

The lids were attached to the forehead by strips of adhesive plaster, and after they were removed at the end of five minutes the patient could keep her eyes open, evidence that the necessary suggestion had been accomplished. Two days later the ptosis recurred, but was again cured by suggestion, this time permanently.

X.—Binocular Vision.

By Dr. **E. JAESCHE**, of Dorpat.

This is mainly a repetition of an article published in 1895, called forth by the position taken by the writer on this subject in the revised *Graefe-Saemisch Handbook*, a position which Jaesche thinks is not tenable.

XI.—Keratosis Conjunctivæ.

By Drs. **MICHAEL MOHR** and **MORITZ SCHEIN**, of Budapest.

L. F., forty-six years old. Duration of condition said to have been a year.

A square centimetre of the conjunctiva above the left cornea was covered by a thin white plate which looked like dried lather, could not be folded, but slipped about on the sclera, and was separated from the cornea by a narrow strip of conjunctiva over which it could not be moved. The conjunctiva was but slightly catarrhal, the refractive media clear, the fundus normal, vision $\frac{4}{4}$. A large part of this tissue was excised.

The epithelium of the pathologically changed conjunctiva was composed of several layers, the deepest (5–7) of which were formed of polygonal prickle cells with vesicular nuclei, which showed some karyokinesis in the deepest layer of all. These were covered by a well developed granular layer, with keratohyalin granules, and this by a thin layer of horn.

XII.—Elastic Tissue in Human Eyes.

By Dr. **AMILCARE BIETTI.**

Remarks called forth by the non-mention of Bietti's name in articles on this subject by Stutzer and Kiribuchi. Bietti claims that the lamina cribrosa is formed almost exclusively of elastic fibres which form trabeculæ, part of which interlace with those which run between the bundles of nerve fibres of the optic nerve, while part are inserted into them. Internally they unite with the elastic fibres which lie about the central vessels, and externally they join with the elastic tissue of the sclera. He also found elastic fibres in the optic sheath.

XIII.—Open Treatment after Operations on the Eyes.

By Dr. **O. WALTER**, of Odessa.

The author considers that open treatment is preferable in most cases, both because the patient is more comfortable and because the eye is more fully under the control of the physician than when it is bandaged. Twenty-seven cataract extractions, twenty iridectomies, and five other operations in which the eyeball was penetrated are tabulated. Infection of the wound did not occur in a single case. Contra-indications to this mode of treatment are the occurrence of severe iritis and the occurrence of severe hemorrhage into the anterior chamber.

XIV.—What Value has the X-Ray Photography in the Detection of Foreign Bodies within the Eye?

By the Late Prof. **L. WEISS**, of Heidelberg.

The testimony on this point as collated from literature is contradictory. Twelve cases in which the method was tried are described in detail. In seven the presence of a foreign body was demonstrated, although they were comparatively very small in two. In one case the first examination was negative, the second positive. In such a case the negative result may be due to the position of the foreign body so that its edge was presented. Another cause which may produce a negative result is restlessness on the part of the patient, which may keep the foreign body in motion. But in many cases the reason why part of the pictures should be negative is not apparent. In four cases repeated exposures gave negative results. In one of these a foreign body was certainly, in another probably, in the eye; in the other two its presence was doubtful. The failure in the first was ascribed to the dense shadows cast by the orbital walls which obscured that cast by the foreign body. In general the orbital walls of elderly people cast greater shadows than those of children and young people. The composition of

the foreign body, whether of metal, stone, or glass, is also of influence on the shadow. In one case the skiagram showed a little shadow which seemed to indicate the presence of a foreign body, but nothing of the kind could be found after the eye had been enucleated. Such a case is an emphatic warning to be careful in the interpretation of X-ray pictures.

XV.—Changes of Astigmatism under Certain Physical and Physiological Influences.

By Dr. **N. BOTWINNIK**, of St. Petersburg.

It has frequently been observed that persons who are myopic or astigmatic sometimes obtain a temporary improvement of vision by blinking. This the author ascribes to a flattening of the cornea thus produced in myopia, or to an increase of the radius of curvature of one meridian of the cornea and a decrease of the radius of curvature of the opposite meridian, which corrects the astigmatism to a certain degree.

In regard to the action of the accommodation, so far as it affects astigmatism, he says:

1. Lental astigmatism produced by uneven contraction of the ciliary muscle has been very often observed and plays an important part in the self-correction of corneal astigmatism.

2. In astigmatism with the rule this irregular action of the accommodation produces an increased curvature of the lens in the horizontal meridian and thereby a more or less important correction of the corneal astigmatism.

3. The degree of corneal astigmatism which may be overcome by unequal accommodative tension ranges between 0.5 and 2.5 dioptres.

4. The unequal activity of the accommodation probably depends on unequal development of different parts of the ciliary muscle, which becomes best developed in those parts by the contraction of which the astigmatism will be best corrected.

5. The unequal action of the ciliary muscle in astigmatism is suited to its purpose and originates in the endeavor on the part of the organism to help itself.

XVI.—Tortuosity of Retinal Vessels.

By Dr. **L. PICK**, of Königsberg.

These may be congenital, in either one or both eyes, usually affecting both arteries and veins, and almost always associated with other congenital anomalies, or they may be pathological, involving the veins alone and associated with other pathological changes due either to local diseases of the eye or to general diseases.

THE CORTICAL REFLEX OF THE PUPIL.

By Prof. O. HAAB, of Zurich.

Translated from the German Edition, October, 1902, by Dr. Matthias Lanckton Foster.

THE recently published monograph by Vidal on the reflexes of the pupil impels me to correct the many inaccuracies which have become current in regard to the reflex of the pupil formerly described by me. I described it briefly in 1885, more fully in 1891, and will quote the latter article here.

"If in a room illuminated only by a lamp or candle-flame, the light is placed so that it will shine laterally into a person's eyes while they look directly forward into the darkness, a marked contraction of both pupils takes place whenever the attention is directed toward the light, with no change in the position of the eyes. As long as the attention is directed to the light and the fixation of the eyes on the dark wall is maintained, the pupils remain contracted, but as soon as the attention is transferred to the point of fixation they dilate, although the quantity of light entering the eye has remained constant and all movements of accommodation and convergence are excluded."

The process by which this is accomplished is rather complicated. We certainly have to do with a reflex which originates in the cortex rather than in the lower centres like the usual reflexes to light, accommodation, and convergence. Perhaps the anatomy of the nerve tract along which this reflex takes its course may be ascertained, but in the meantime it is interesting to study how greatly affections of the

cortex may influence the pupils. We may perhaps assume that the anomalies of the pupils which are often met with during the early stage of any circumscribed disease of the cortex are directly attributable to that disease. This reflex also proves that a prompt pupillary contraction is produced by the stimulus of light when it falls not only on the macula lutea but also on any other portion of the retina.

This reflex can be observed and demonstrated both in one's own eyes and in the eyes of others, but while the experiments are not difficult, certain precautions and a certain amount of practice are necessary in order to exclude errors.

OBSERVATIONS ON ONE'S SELF.

This observation may be made by the entoptic method, which is the simpler and easier, or by means of a mirror. For either method it is requisite that the pupils be very movable, as the reflex might be obscure in persons of advanced age whose pupils are small and slow of reaction. It is also requisite that the observer should be able to hold his eyes quiet on an object and at the same time direct his attention to another object in the peripheral portion of the field.

To observe this reflex by the entoptic method, a lamp is placed at one side so that its light will fall on the eye at an angle of about 45°, while the eye itself looks directly forward. A card with a fine hole in it is held *2cm* in front of the eye which is the more distant from the lamp, while a large sheet of white paper is hung vertical before the eyes at the same distance as the light itself, in such a way as to be fairly well illuminated. Both eyes are directed toward this sheet of paper. The entoptic picture of the pupil then appears as a little bright disk. If the attention is now directed to the light which shines into the one eye, the little bright disk is immediately seen to become smaller, but for only a brief space of time if the attention is voluntarily or involuntarily transferred from the light. It is only with difficulty and considerable practice that a comparatively prolonged contraction can be brought about, because it is not easy to direct the attention for a prolonged interval to an object in the periphery of the field, and in this observa-

tion it is rendered the more difficult by the fact that as soon as the contraction of the pupil occurs it distracts the attention.

With a mirror the movements of both pupils can be observed. Usually, the degree of contraction observed is greater than that seen by the entoptic method because a greater amount of light is reflected into the eyes from the white paper, the presence of which is necessary for the production of the entoptic picture, than enters them when fixed on a dark object in a mirror. Consequently the pupils are larger to start with when the mirror is used, and the contractions are more marked. The best dark object one can use is the reflection of his own pupil. The light is placed as before, 45° to the side, while the eyes are fixed on the reflection of one pupil in a mirror. A concave mirror is preferable, as a larger image is thus obtained. It is important to regulate the quantity of light carefully, because if it is insufficient the pupils cannot be seen clearly, and if too great they will be rendered so small that the contraction will be but slight. It is also advisable to have the light fall on one eye only, while the other is shaded in such a way as not to interfere with direct vision, because it is much easier to observe the movements of the pupil when both eyes can be used for the purpose, and to observe in the mirror the reflection of the illuminated pupil. The pupil is seen to contract as soon as the attention is directed toward the laterally placed light, and to dilate again when the attention is transferred to the object of fixation. If the attention is directed wholly into the darkness of the pupil, the latter dilates, and then immediately contracts when the attention is directed to the light, although the eye is not moved in the least.

This reflex can be demonstrated with the substitution of some other bright object, but a lamplight in a dark room gives the most satisfactory results.

OBSERVATIONS ON OTHERS.

This is not difficult, but if one has to deal with a person who is unaccustomed to indirect vision it is better, though

perhaps not necessary, to institute a preliminary course of training by having him look one in the eye and count fingers held at the side without shifting his gaze. Then the experiment is thus performed. The observer sits in a darkened room in such a position that he can see plainly the pupils of the person undergoing the experiment. The light is placed at one side so that the observed eyes are sufficiently illuminated and the eyes of the observer are not altogether in the shadow. The person under observation is then directed to gaze steadily into the observer's eye, and after he has done so awhile he is asked whether he can see the light at the same time. A contraction of the pupil can be plainly seen the moment his attention is directed to the light. If he glances toward the light, the experiment is to be repeated until no such motion is made. When the experimentation is prolonged, the phenomenon usually becomes less clear, because the attention is no longer wholly withdrawn from the light, but if his attention is then called for a few moments to some peculiarity of the eye upon which his own is directed, and then redirected to the light, the pupils contract again. The phenomenon can be seen better in a young than in an old subject, because the pupils are more active.

This contraction of the pupil can be thus produced when the light is placed above, below, or in any other portion of the visual field. I can obtain a clear though slight reflex on myself when the light is placed 80° to 90° to the temporal side of the point of fixation. It is most marked when the light is placed at about 45°. When the light is brought nearer to the point of fixation than 45°, the pupil becomes smaller and its reaction less, and when it is moved nearer to the margin of the field, the reaction is less, because it is difficult to direct the attention sufficiently to an object in the very peripheral portion, and perhaps also because the light falls on a less sensitive part of the retina.

The contraction and subsequent dilatation take place simultaneously and equally in each eye, the same as the so-called consensual reaction of the pupils.

If a small bright object, like a piece of white paper, well

illuminated, is substituted for the lamplight, a much slighter contraction of the pupil is obtained when the attention is directed to it, and if this object is again replaced by a black one, there will be no contraction. The strength of the reflex is proportional to the brightness of the object to which the attention is directed.

It is plain that this contraction of the pupil is not due to accommodation or convergence. We are not accustomed to accommodate for objects seen indirectly, and accommodation is particularly impossible when the eyes remain turned directly toward an object. If the light was brought nearer the eye than the object of fixation, and an attempt was made to accommodate for the light, the object of fixation would appear indistinct, or, in a binocular experiment, as with the mirror, double. In performing these experiments, the light should be placed at the same distance from the eye as the object of fixation, so that no question of accommodation or convergence can be raised.

It is also plain that the contraction of the pupil does not result from the entrance of more light into the eye, because the quantity of light remains the same for each eye throughout the experiment.

It is also evident that this pupillary reaction has nothing to do with the dilatation and contraction of the pupils which one may induce by imagining himself in a dark, or a light room, as described by Budge, or by imagining himself to be looking at a distant or a near object, as mentioned by Domrich. Likewise the apparently voluntary dilatation of the pupil mentioned by Brücke and Schmeichler does not seem to me to be the same as this.

This is then a pupillary reflex which is not excited by the recognized causes: entrance to light, accommodation, convergence, irritation of sensitive nerves, or severe muscular exertion carried to the point of dyspnœa, but is produced psychically by the direction of the attention at one time to a bright object visible somewhere in the field of vision, at another to a dark object constantly present at the point of fixation. The transference of our attention to an object in the visual field is a process which without doubt takes place

in the cortex, so this reflex may be briefly designated as a cortical reflex of the pupil.

If this be correct, it follows that descending fibres must run from the cortex of the brain to the oculomotorius, the stimulation of which is transmitted through the pupillary fibres, and that something takes place in the cortex which permits the transmission of the stimulus received through the optic fibres to those descending fibres. When we perform these experiments, a constant stimulation by light is carried to the cortex by way of the optic tract, but only when the attention is directed to the retinal image of the flame is this stimulation communicated to the descending fibres and the pupils made to contract. As long as no attention is paid to the light, these fibres are less stimulated, even if they are stimulated at all.

These fibres which unite the cortex and the pupil are analogous to those which unite the cortex with the rest of the oculomotorius and the nerves of the other eye muscles, and they have the innervation through which the eyes are turned when an object appears at one side. This reflex must be present when we observe objects by indirect vision, and the first impulse is to call into action the muscles to direct the eye toward the object so as to receive its image on the macula. As both pupils contract equally, even when the light enters only one, it follows that these pupillary fibres extend from each hemisphere to both eyes. Whether they pass from the cortex to the oculomotor nuclei in the corpora quadrigemina, or go directly to the pupils, is undetermined at present. Their course may perhaps be ascertained by pathological investigation.

From the above it is evident that contraction of the pupil can be caused by the entrance of light into the eye not only when it falls on the macula, or its immediate neighborhood, as claimed by Heddæus, but also to a greater or less degree when it falls on any portion of the retina. The reaction is greatest when the light falls on the macula.

This reflex explains in part the peculiar little oscillations of the pupil in normal individuals, a phenomenon which has been noticed many times and received various explanations.

Schmeichler has thus described them: "If an artificial light in a darkened room is held before one eye while the other is closed, the pupil contracts, then dilates, recontracts, redilates, and so on, the fluctuations being arhythmic and of varying degrees. They do not occur if daylight is allowed to enter the eye, nor if both eyes are fixed on the light." He ascribes these oscillations to slight motions of the light itself as well as of the eye, which is not accustomed to fix alone, that cause the light to fall more or less peripherally from the macula. When the light is unsteady, or the eye is restless, such an explanation is sufficient, but it is not when the light is steady and the eye quiet. He also describes slow fluctuations in the size of the pupil which are not to be ascribed to the cortical reflex.

OBSERVATION OF THE REFLEX ON PATIENTS.

During the past year I have frequently proved the presence of the cortical reflex and sought to utilize it in the explanation of clinical symptoms. I believe that in certain diseases of the brain it can sometimes furnish valuable information, and that therefore the results of examinations regarding it should be considered together with the rest of the symptomatology, although its value may be impaired by the dependence we have to place on the patients. When the result of the examination is positive, it is useful, but when negative, with an otherwise freely movable pupil, we may not know whether it is because the patient does not turn his attention to the light, or because there is a lesion in the tract or at the centre. Yet this result may be of value if we can prove that the patient can see indirectly, either by means of the perimeter or by counting fingers held at the side. When the result is negative, the examination should be repeated several times, perhaps on different days. Tired persons cannot concentrate their attention well, hence the results of examination of such persons are not so satisfactory. The presence of scotomata or a marked contraction of the field of vision will prevent the occurrence of the reflex.

Whenever there was a good pupillary reaction I could

usually obtain the cortical reflex, but when it was not very movable, as in tabes, general paralysis, and oculomotor paralysis, I could not. My colleague, Prof. Forel, had the opportunity to examine a number of cases of dementia paralytica in the early stage when the pupils still reacted to light and usually found the reflex to be absent or slight, but in one case it was plainly seen. These few observations show that the reflex can be demonstrated even in paralytics when the disease has not become too far advanced.

I was able to demonstrate the reflex in two cases of paralysis of the accommodation, but failed to do so in a case of nuclear paralysis of the eye muscles with good reaction of the pupil to light and accommodation. I found it present in numerous neurasthenic and hysterical patients, even when derangements of the eye were present. The determination of this reflex in diseases of the occipital lobe is of greater importance, because it can afford valuable assistance in the localization of the disease.

Emmert in 1886 and Heddæus in 1896 pronounced the reflex I had described to be purely accommodative. Both believed that when the attention is directed laterally to a light an accommodative action is brought forth. If they had studied this reflex on themselves they would have been spared their erroneous interpretation. But on the basis of an observation on another person Heddæus concluded that when a person stared for some time at one and the same object his retina became tired and he finally saw nothing, while with his attention his accommodation relaxed and his pupils dilated. If he were then roused from his staring, or dreaming, by any stimulus, whether sensory, optical, or acoustical, he involuntarily exerted his relaxed accommodation and produced a contraction of the pupil.

It is impossible to learn the truth from such a caricature of my experiment. I excluded such an accommodative contraction of the pupil when I said: "If a small bright object, like a piece of white paper, well illuminated, is substituted for the lamplight, a much slighter contraction of the pupil is obtained when the attention is directed to it, and if this object is again replaced by a black one, there will be no

contraction." This Heddæus could have demonstrated. Besides it is easily determined that during the demonstration accommodation plays no part, because:

1. There is no change of convergence.

2. The object of direct fixation is not obscured. When a marked contraction of the pupil is caused by activity of the accommodation, the latter must be sufficiently great to enable an experienced ophthalmological observer to notice it.

Moreover, the observation of the reflex on another person should not be made in the way Heddæus describes. I said: "The person under observation is directed to gaze fixedly into the observer's eye, and after he has done so a while, is asked whether he can see the light at the same time." While he thus fixes constantly I cannot understand how his accommodation can relax, and there is no occasion for staring or dreaming. Of such conditions I say nothing except with regard to that caused by many repetitions of the experiment: "If his attention is then called for a few moments to some peculiarity of the eye upon which his own are fixed, and then redirected to the light, contraction of the pupil again occurs." Toward the end of my paper I mentioned that poorer results are obtained in tired persons, because they cannot concentrate their attention so well. Such an occurrence as that described by Heddæus has nothing to do with the cortical reflex and is to be differentiated from it.

Heddæus claims that he can unmask simulation of scotomata by means of the reflex which I described, but I must call attention to the fact that the method in which he proposes to do this differs both in its execution and its explanation from that which will produce this reflex. He holds a white or glistening object in the supposedly defective portion of the field quietly at first, then moves it slightly back and forth. If the pupil contracts in response to this motion, it betrays that the object is seen. This would be true in accordance with Heddæus's theory that the person under observation relaxes his accommodation completely when looking the observer in the eye, and that

the movement of something in the supposedly blind portion of the field would cause the accommodation to act, not for the object in motion but for the directly fixed eye. But this, if it has ever been really observed, is quite different from the cortical reflex. This reflex has only a limited value in the detection of simulated scotomata. If we can obtain the usual reaction to light in the supposedly defective part of the field, it is almost certain that the defect is simulated, provided that the same defect is not shown in the other eye. For it is only in cases of derangement in the occipital lobe that a pupillary reaction to light can be obtained in spite of the blindness by illumination of the blind part of the eye, and in such cases the defect must be present in both eyes. If the defects in the two eyes are not homonymous, the lesion cannot be in or near the cortex. But when the other eye is absent or blind the cortical reflex may be useful for diagnosis. I would then try to excite the reflex in the usual way, by having him look in my eye and then asking him whether he truly did not see the light which had been placed in the blind portion of the field. If he should really see the light, it is very probable that when asked about it he would direct his attention to it and cause his pupil to contract. He would also be apt to find some difficulty in withdrawing his attention from the light, so there would be likely to be alternate contractions and dilatations of the pupil coincidently with quiet fixation of the eye and a quiet light, which would prove that he saw the light.

Likewise I must make a correction with regard to the value of this reflex for the demonstration of a hemianopic pupillary reaction, because Heddæus's statement is likely to cause error. In the case quoted from Vossius, the left eye was blind from optic atrophy and the nasal part of the right retina was amaurotic. There was no reaction of the pupil when light was thrown on the blind part of either retina, but such a reaction did appear when the light was thrown on the temporal portion of the right retina. In such a case the cortical reflex could not be deceptive if tested for according to my method. But the contrary is true if Heddæus's method is employed, because in that way

an accommodative contraction of the pupil could be produced. Heddæus says that by throwing light into the eyes of hemianopic patients, first from one side and then from the other, we can ascertain whether the common light-reflex is excited or not—in other words, whether the blind portion of the retina has lost its susceptibility to reflex along with its subjective sensibility, or has retained its ability to transmit a light stimulus to the oculomotor centre through the centripetal pupillary fibres, but Haab's attention reflex cannot be excluded when the patient uses the portion of the retina which retains the power of vision.

If I understand Heddæus aright, he means that the contraction of the pupil could be produced in the following manner: The light stimulus falls on the portion of the retina in question, is transmitted wholly through the fibres which join the eye to the cortex, not at all through the centripetal pupillary fibres and the oculomotor nucleus, and then this cortical stimulation produces an accommodative contraction of the pupil. In that case an unconscious patient would be the best subject on which to demonstrate the purely hemianopic pupillary reaction. As I have said, Heddæus's standpoint is incorrect. He says that when we obtain a better contraction of the pupil by the illumination of the portion of the retina which has retained the power of vision than by that of the blind portion, we have to determine whether this is due purely to the greater reflex excitability of the functionating portion of the retina, or whether Haab's cortical reflex plays any part, and that no observations of hemianopic pupillary reaction in which this distinction has not been made have any claims to scientific value.

This verdict, which would render worthless almost every investigation of hemianopic pupillary reaction hitherto made, may be quietly cancelled. The cortical reflex has only a very limited degree of value in the study of hemianopic pupillary reaction, as may be shown by a few examples which cover the principal types.

First case. Let there be a left-sided hemianopsia due to a cortical lesion in the right occiput. The light stimulus which falls on the right or blind portion of the retina of the right or

left eye will produce a direct and consensual contraction of the pupil, because it can pass without interruption from the optic nerve to the oculomotorius. In such a case, the cortical reflex does not come into consideration, the right portion of the retina, or the left portion of the field, is blind, and the process of attention is impossible.

Second case. Let there be a left-sided hemianopsia due to a lesion in the tract of the right side. If light is allowed to fall on the blind portion of the retina of either eye, there will be no pupillary reflex, because the course of the centripetal pupillary fibres is broken. In such a case, also, the cortical reflex can play no part.

Third case. Let the conduction be intact in the visual fibres from the retina to the cortex, but interrupted in the centripetal pupillary fibres on one side, centrally from the chiasm. Then, assuming that this interruption is in the right hemisphere, if light is allowed to fall on the right side of the retina, no reflex will be produced although the visual power is good, while the reflex will be prompt to light thrown on the left side of the retina. In such a case, the cortical reflex may possibly be of use. No reflex is produced when the light falls on the right side of the retina, because the stimulus is not transmitted through the corpora quadrigemina and the oculomotor nucleus in the usual way, but if by means of attention the stimulus is transmitted to the cortex through the visual fibres, and if the cortex takes cognizance of that stimulus, the cortical reflex will be produced. But if the cortex will not respond to such a stimulus the pupils will remain quiet.

Fourth case. Let the centripetal pupillary and visual fibres to the cortex be intact and able to perform their functions, but the conductivity of the fibres which transmit the attention reflex from the cortex be interrupted. The course of these fibres is not known, perhaps they go to the oculomotor nucleus. If we assume that they extend to the pupillary part of the oculomotorius in its nucleus and are injured, for example, just before their entrance from the cortex of the right hemisphere, it might happen that, while the usual reflex to light could be obtained on both sides of

each retina, hemianopsia would be absent, the attention could be turned to a bright object in either the right or the left portion of the field, and there would be no cortical reflex when the light fell on the right side of the retina, though present when the light fell on the left side. This would be a true hemianopic pupillary reaction for the cortical reflex. We must remember that this reflex would be excited in both eyes from each hemisphere, and that somewhere, probably in the region of the oculomotor nucleus, descending fibres from the right occipital cortex must pass over into the left hemisphere. Whether such a case as this last is possible or not must remain uncertain until we know definitely:

1. Whether the cortical reflex of the pupil really follows the course I have indicated or not, and

2. Whether the descending fibres from the cortex to the oculomotorius enter the oculomotor nucleus, as is probable, or not.

Regarding the existence and course of centrifugal fibres from the optical centre in the cortex to the eye, we have meagre information. Monakow says: "Another question is whether the visual centre is wholly for the reception and disposition of retinal stimuli, or is partly for other purposes. From the experiments of Schäfer, Munk, and Obregia, it may be assumed with certainty that anatomical elements lie strewed about in the visual centre which are for the associated movements of the ocular muscles. Stimulation of the cortex of the occipital lobe usually causes a lateral deviation of the eyes toward the side opposite that on which the stimulus is applied, and there are fibres which run centrifugally from their origins in the large solitary pyramids of the third cortical layer in the direction of the mid-brain." The same author also says that the experiments of Obregia, Munk, and Baginsky, as well as the deductions of Knies, indicate that the true cortical centre for the movements of the eyes coincides with the visual centre, at least so far as movements due to stimulation by light are concerned. If this is so, it is not an unwarranted assumption that pupillary contraction, which is closely associated with convergence, may start from the visual centre in the occipital lobe.

From the foregoing it is evident that in the principal forms of hemianopsia the cortical reflex can have no great influence on the hemianopic pupillary reaction, while there may be cases in which it would be judicious to take it into consideration, and some cases in which it might aid in the localization of the lesion.

I think Heinrich likewise is incorrect in his interpretation of the cortical reflex. He entered into an investigation to determine whether Helmholtz's theory, that the attention is independent of the accommodation and position of the eye, is correct or not. In doing this he wished to learn whether changes of accommodation were coincident with changes of the attention, and for this purpose studied the changes in the pupil and lens. The size of the pupils was determined:

1. In central fixation.
2. In indirect vision.
3. During calculation.

The pupils were observed by means of the ophthalmometer. The distance of the point of fixation from the eye was 40*cm*, in one case 32*cm*. In all his experiments, the right eye was blindfolded and the left alone was examined temporarily in the horizontal meridian. The objects used for indirect vision were letters on white oblongs to be seen by the person experimented on. Calculation was mental. The results of a great number of measurements on three men were that:

1. When the attention was turned to what was seen laterally, the pupils dilated to a degree dependent on the angle at which the object was seen. The dilatation was greatest when the angle was 45° or 50°, and became less as the object approached the periphery of the field.

2. When the attention was wholly turned from the object of fixation, the pupils dilated most widely.

To determine whether these changes in the size of the pupils were due to an accommodative impulse, or were independent, Heinrich instituted a similar series of observations on the lens by measuring the radius of curvature of its anterior surface, to learn whether the pupillary movements corresponded to adequate changes in the lenticular

curvature. He found that the accommodation diminishes when the central point is not fixed, but the attention directed to a point situated laterally, and that the eye no longer accommodates when the attention is given to calculation, although the line of vision remains unchanged.

If we consider the radii of curvature of the anterior surface of the lens on which these conclusions are based, we find in the eye of Mr. J. U., which was slightly hypermetropic, the average of thirty measurements in central fixation of an object 32*cm* distant, radius 10.6898; in indirect fixation of an object 40° to the side, radius 12.3401; in indirect fixation of an object 70° to the side, radius 12.0440; in calculation with direct fixation of object 32*cm* distant, radius 12.0984; in direct fixation of a point 384*cm* distant, radius 15.4830; in direct fixation of a point 15*m* distant, radius 17.0620; in calculation with fixation of object at 382*cm*, radius 19.1006.

The conclusions Heinrich draws from these and similar figures obtained from observations on other persons are that the flattening of the lens during mental calculation is greater than in distant vision, so that it assumes the same form as that produced by the action of atropine, and that during contemplation of an object in the lateral portion of the field the accommodation is shown to be relaxed by the flattening of the lens and the dilatation of the pupil.

He also concludes from a more extended series of experiments:

1. That the eye usually is able to accommodate for objects lying paraxially.

2. That the accommodation was incomplete in the observed cases, but dependent on the position of the axial fixation-point.

3. That the paraxial accommodation results in the coincidence of the first focal line with the retina on the vertical plane of incidence.

4. That the amplitude of the paraxial accommodation is less than that of the axial. From the determination of the changes of curvature it appears to be first decreased and then increased as the angle becomes greater (40° to 60°).

From all of which Heinrich concludes, in opposition to the view of Helmholtz, that it is not the attention which picks out certain impressions, but that the physiological conditions change, so that for the time the action of the stimulus is favored, and therefore the impressions are clear. I do not clearly understand how this statement improves or can take the place of Helmholtz's exposition. I cannot enter into a criticism of the complicated work, but I feel I must say that it would be advisable to undertake the experiments with binocular fixation of the central point in order better to exclude fluctuations of the convergence and accommodation. I may be wrong, but my judgment is that it is necessary to take into account in these experiments the difference between monocular and binocular fixation, or else to show the insignificance of binocular fixation as used by Helmholtz in his experiments.

Heinrich's argument by which he makes the exactly opposite results obtained by his experiments conform with the reflex I described is perfectly incomprehensible to me. I obtained contraction of the pupil on observation of a paraxial object, he saw dilatation. He says: "It is clear that central fixation greatly reduces the influence of the stimulus upon the periphery of the retina, and a very beautiful observation by Haab immediately demonstrates it." (My description of the reflex follows.) He also says: "The apparent contradiction between my observations and those of Haab is easily explained. I interpret them differently, because Haab relied on the generally accepted, but incorrect, assumption that the accommodation does not change." Granted that Heinrich interprets his experiment correctly and that an accommodation really takes place toward objects which lie laterally in the visual field, an assumption which does not seem to me to be unobjectionable, in the first place according to his experiment this accommodation is slight and incomplete, and in the second place it is decreased instead of increased in indirect vision. How can such slight action of the accommodation be made to accord with the well-marked pupillary movements obtained in my experiments, and with the contraction instead of dilatation of the

pupils? Heinrich says that he infers from my observations that at the moment when the eye accommodates to the flame the influence of the stimulus suffices to induce a reaction of the pupil to the light, a reaction which lessens when the eye ceases to accommodate for the flame. Consequently when a flame is taken as the object for which the eye is to accommodate, a pupillary reflex appears which displaces the dilatation that should result and causes a contraction. This he thinks seems to explain the contradiction between the results of our observations. If I understand Heinrich correctly, his position is this: When the attention is directed to the flame of a lamp placed laterally, the accommodation relaxes, but the pupil nevertheless contracts, because the retinal image of the flame is rendered somewhat sharper by the paraxial accommodation, and the increase thus given to the light stimulus already present suffices to produce a light reflex. I doubt the correctness of this conclusion for two reasons:

1. As Heinrich himself says, the paraxial accommodation is incomplete and is dependent on the position of the paraxial fixation point. But the cortical reflex appears with strength, no matter how the central fixation point lies, and its strength is out of proportion to the slight increase in the sharpness of the retinal image.

2. If I fix centrally a lamplight 1*m* from my eye, hold a pin-point before the flame 25*cm* from my eye, and change my fixation from the light to the pin-point, similar conditions are produced to those assumed by Heinrich for paraxial vision. If I fix on the pin-point, I do not obtain a sharply defined picture of the flame. The latter I obtain when I allow my accommodation to relax and fix on the flame. According to Heinrich, the increased sharpness of the retinal image of the flame, produced by relaxing the accommodation, so increases the light stimulus, that instead of dilating, the pupils should contract. But this does not happen, they dilate when I look from the pin-point to the flame. Hence I consider Heinrich's interpretation of the cortical reflex to be incorrect.

Pilz has supplemented my paper by the observation that

when the attention is directed to a laterally placed black surface the pupil dilates. The play of the pupil is particularly active when the attention is directed alternately to a light on one side and a black object on the other, with a moderately illuminated surface directly in front. This amplifies my own observation that the pupils dilate when the attention is directed to a central black object. For the demonstration of this experiment, the methods I have given for observation on one's self are of little use; it is better to employ another suitable person.

Pilz also observed that the mere idea of light and dark produced contraction and dilatation of the pupils.

I must briefly mention an article by Baas because it needs a slight correction. He says first of all that I place the centre of the cortical reflex in the gray cortex whence the ascending and descending fibrous tracts pass only to the corpora quadrigemina. His explanation of the manner of its production is that the attention acts as a tonic factor in the cortical centre so that the hitherto ineffective light stimulus becomes effective and arouses a centrifugal impulse proportionate to the centripetal. It is therefore a psychically produced reflex, the centre of which is at the usually recognized place.

My correction is that I simply say: "Whether they (the pupillary fibres) pass from the cortex to the oculomotor nucleus in the corpora quadrigemina, or go directly to the pupil, is undetermined at present." I have not declared that the descending tract passes only to the corpora quadrigemina; I named the oculomotor nucleus there as a way station, or lower centre, and when I said "go directly to the pupil," I simply pointed out this possibility while I put it in the second place.

Now that we have gained a broader view of the structure of the nervous system through our knowledge of neurons, I incline more than ever to the opinion that the cortical fibres which conduct the reflex I have described pass to the oculomotor nucleus, and that there a new neuron receives the stimulus, perhaps even with the intercalation of another

neuron. Monakow says it is agreed that there is at any rate a direct cortical connection with the group of cells of the oculomotorius. For a further consideration of this subject I refer to the work of this author.

As long as we are so little acquainted with the exact topography of the centripetal and centrifugal reflex tracts for the reaction of the pupil to light as we are at present, it does not seem advisable to express one's thoughts too freely regarding the connection of this reflex arc with the cortex, because they are only conjectures, but I believe that the movements of the pupil are influenced by the cortex more than has hitherto been supposed.

The suggestion of Baas, that the attention acts as a tonic influence in the higher cortical centre, seems to me to be simply a circumlocution which does not explain what takes place in the cortex to cause a contraction of the pupil when the attention is directed to the retinal image of a light. It is as unexplainable as the experiment of Helmholtz by which it was shown that one can voluntarily direct his attention to a certain point in the dark visual field before he glances thither, and then during the glance gain an impression solely of the object which appears in that part of the field. Helmholtz says that his experiment may prove very important in a future theory of attention, and I believe that I can echo his words with reference to the cortical pupillary reflex which I have discovered.

REPORT OF THE OPHTHALMIC SECTION OF THE BRITISH MEDICAL ASSOCIATION MEETING AT OXFORD.

By Mr. C. DEVEREUX MARSHALL.

WEDNESDAY, JULY 27, 1904. MR. R. W. DOYNE, PRESIDENT, IN THE CHAIR.

Mr. Marcus Gunn opened the discussion on **retro-ocular neuritis.** He stated that the terms retro-ocular or retro-bulbar neuritis indicated an inflammatory affection which exerts its chief influence behind the papilla; although the diagnosis may rest for a time on subjective symptoms, yet ophthalmoscopic changes nearly always come to our aid.

In the early stages, when our diagnosis rests merely on subjective symptoms, retro-ocular neuritis is liable to be simulated by functional amblyopia, though a careful examination of the pupil should not leave us in doubt.

The amount of amblyopia varies much from normal vision to absolute blindness. The light sense as tested by Bjerrum's types is decidedly defective and the color sense is impaired. The visual field is lost in varying degrees, but the central portion is always involved, due to interference with the macular fibres. One of the distinguishing features is the rapidity of visual failure, this being in contrast to the length of time that papillitis may be present without defective vision, though the failure is never sudden as in embolism. Recovery soon takes place, the final result being frequently reached in about six weeks from the commencement of the attack.

Exceptionally no recovery takes place at all.

Pain is frequently complained of and if it persists the prognosis is more grave. Tenderness indicates inflammation far forward and is thus favorable.

Slight changes in the disk begin early as a rule, when the lesion is far forward, and the presence of papillitis does not preclude a favorable visual result.

Pallor of the disk is practically universal, and in severe forms the disk ultimately becomes atrophied.

The ætiology was then discussed and the causes grouped as follows: (1) Inflammation communicated to the nerve from the neighboring structures, such as orbital periostitis, and occasionally from the sclera itself in gouty and rheumatic subjects, similar to the episcleritis with which we are familiar in the front of the eye.

Exposure to cold is another cause, as also is inflammation spreading from abscesses at the root of teeth and from the sphenoidal sinus.

(2) Inflammation occurring initially in the optic nerve, such as a gummatous deposit, and finally the large class where there is no evidence of the nerve being affected from surrounding structures. They are called "primary," and a large number of these are due to insular sclerosis. Influenza accounts for many, as well as numerous other conditions that affect the general health.

Considerably more women than men are affected in the primary cases, while the average is 37.25 in the male and 31.5 in the female.

Discussion Following Mr. Gunn's Paper on Retrobulbar Neuritis.

Dr. BERRY considered what Mr. Gunn had said was so complete that but little remained to be added. He (Dr. Berry) thought that by far the most important point regarding diagnosis was the light-difference sense, and a sudden onset indicated pressure as a cause. In influenza the olfactory nerves are often affected at the same time, but the recovery of smell is not so likely to occur as that of sight.

Prof. UHTHOFF said that his experience of the pathological anatomy of retrobulbar neuritis was rather extensive, and he produced some very pretty drawings of the conditions found. The toxic cases have really retrobulbar neuritis, and he regarded the degeneration of the optic-nerve fibres, in some cases at least, as the result of interstitial inflammation, though it is impossible in any but recent cases to say whether the nerve fibres are primarily or secondarily affected, though inflammation may attack a certain portion of the nerve and lead to both ascending

and descending degeneration. He mentioned several symptoms of the disease that point to the primary seat of the disturbance being in the optic nerve, and thought that drawing conclusions from the neuron theory had not always helped toward the elucidation of the processes of the disease.

In spite of the fact that a central scotoma is by far the most frequent anomaly of the field, we must avoid looking upon the disease of the papillo-macular bundles as a systemic affection; in true cases not due to toxic agencies the size of the scotoma varies greatly.

Contraction of the peripheral field is much rarer than the development of a central scotoma, occurring in about 8 % of his own cases. He showed specimens due to gummous infiltration, and proved the fact that the inflammatory process in retrobulbar neuritis may start in various portions of the optic nerve. When pain is present on movement of the eyeball, it indicates that the inflamed patch is close behind the eye.

Out of 120 cases he was in more than half unable to find the cause of the condition; in the others, various conditions led to it.

Mr. C. Higgens related the case of a young lady who suffered from optic neuritis in one eye in 1897, and this was followed later by scotomas in the other part of this field, which by degrees developed into complete blindness without noticeable ophthalmoscopic change. The patient died and the autopsy revealed general meningitis with complete destruction of the optic nerves.

Mr. Richardson Cross said that the term retrobulbar neuritis seemed to include a very large number of differently caused cases in which certain symptoms were present. Some are chronic and some acute and the symptom that he mainly relied upon was the scotoma for red and green, often in addition to that for white, as well as a more or less rapid loss of vision. Usually on very careful examination a pallor or blushing of the nerve is present. A definite papillitis should be given its usual name and excluded from this group. Any part of the nerve may be affected, and when the part near the eyeball is affected there will be pain on pressure and a history of cold or of blood poisoning. On examining the field of vision, some impairment at the periphery will be found, while a central scotoma may be absent. It is possible that blood changes, such as anæmia, may cause defects of function which may resemble retro-ocular neuritis.

Dr. C. O. Oliver (Philadelphia) agreed as to the great value

of observing the light sense, and discussed the method he adopted for examining these cases. He made mention of two well-known though imperfectly studied cases of hereditary retrobulbar neuritis. He has found that the condition invariably appears as a low-grade optic neuritis with all its concomitant signs and symptoms ; slow and progressive degenerative changes followed. He had obtained specimens of the visual apparatus from affected members of the sixth, seventh, and eighth generations, and he hoped to be able to trace the collateral branches of a female born and living in England in 1640, from whom the affection has been directly traced.

Dr. HILL GRIFFITH said that his idea of a typical case of retro-ocular neuritis is one in which there is rapid deterioration of vision in one or both eyes, with periorbital pain, the presence of a central scotoma, and complete or nearly complete restoration of sight. He thought that some were due to inflammation of the sclerotic at the entrance of the optic nerve.

He could not understand how it was that such cases should be mistaken for functional amblyopia.

He related the case of a young man whose sight rapidly failed without known cause. The fundi were absolutely healthy. Four generations each furnished several examples of apparently similar defects of sight.

Mr. NETTLESHIP agreed with Dr. Berry in the diagnostic value of the diminished light sense, but he considered that slight ophthalmoscopic changes were much more common than Dr. Berry seemed to think. He thought that direct exposure of the patient or his head to cold was a more frequent cause than Mr. Gunn seemed to have stated.

Mr. VICTOR MILLER thought that rheumatism and cold were two frequent causes of the disease. He gave details of three cases which arose in this way.

Mr. GUNN in reply said that of his cases twenty-seven were due to cold, which was a large proportion. Certain rare cases associated with severe throat and nose inflammations were instances of orbital cellulitis and some of affections of the sphenoidal sinus. The slighter proximal forms of neuritis after exposure to cold occurring in rheumatic and gouty subjects were considered by themselves. Finally, in one or two cases where there had been a sudden change from heat to cold, these seemed to fall in most appropriately under the heading of shock.

Dr. GROSSMANN (Liverpool) read a paper on **a case of astigmatism with varying axes.**

Discussion on Dr. Grossmann's Paper.

Dr. BERRY thought that the more common explanation of the change of axis and amount of astigmatism was correct and depended upon the size and position of the pupil.

Dr. G. BULL (Paris) thought it imprudent to draw conclusions as to the mechanism of accommodation from the case mentioned as the refraction always varies so much with different sizes of the pupil. He related a case in which changes in the astigmatism took place from time to time, and this turned out to be a case of conical cornea.

Dr. GROSSMANN, in reply, said that the explanation of Dr. Berry was well known to him; it did not, however, apply to his case, in which the whole surface of the cornea had been examined by a Helmholtz ophthalmometer.

He also pointed out that a trace of keratoconus was present in every cornea if examined with sufficient care.

The principal weight lay in the lenticonus; the anterior variety had been known for some time, but the posterior one was last year proved by him to exist. This became more marked with advancing years, and had not hitherto been reckoned with.

Prof. MCHARDY read a paper on the **artificial maturation of immature senile cataract by trituration** as practised during twenty years, and the more he did it the more confident did he become of its utility. Complete ripening may be almost certainly secured in from three days to eight weeks after preliminary iridectomy with trituration of the lens through the cornea and pupil, done with judgment and care, and the ultimate results are quite equal to those that have been allowed to ripen naturally. Latterly, with increasing experience he has not lost an eye, and the results have been most gratifying, though there is no operation which requires more personal experience and judgment for its safe carrying through than does this one. Six or eight weeks should elapse between the trituration and the subsequent extraction, and the eye should always be under atropine when operated upon.

Out of an analysis of 100 cases, quoted in 1890, 97 were successful and 3 were failures.

He now advocated preliminary iridectomy in both eyes with

trituration of one, and described in detail the operation. He looks for a visible change in the lens in from two to eight days later. These artificially matured cataracts come out very well indeed, and there is now no case of immature senile cataract, with greatly hampered vision, in which he would anticipate any ill effect ; and he related a most unfavorable case that did quite well and now has $\frac{6}{12}$ vision.

His latest statistics show that in only 1.5 % was the cataract insufficiently ripened. In 1.25 % there was troublesome but controllable iritis. In 1.5 % there was a slight loss of vitreous, and in 0.375 % was there total failure to restore sight at subsequent operation.

Mr. HIGGENS said he had given up maturation years ago, and he never did an iridectomy if he could possibly help it.

Dr. HILL GRIFFITH said he had performed the operation ever since Mr. McHardy brought it before the profession, and has seen no bad results which could be assigned to it. It is often unnecessary, but he felt greater confidence in extracting after trituration than in removing a semi-clear lens.

Mr. TATHAM THOMPSON recalled three cases he had reported ten or twelve years ago in the *Moorfields Hospital Reports*. In the case of two males a complete cataract was removed within six or eight weeks, but in that of the female the lens cleared up, and up to the present date the patient is using that eye, though the lens that was left alone has gradually become increasingly opaque. He still employed this method in certain cases and had no fear of ill results.

He, however, thought that the need of this procedure was much less than formerly, now we are able to wash out the anterior chamber by the method of the late Dr. McKeown.

Dr. GROSSMANN said he had performed the operation many times, and although there were no disagreeable consequences the result was practically nil as far as the desired effect was concerned. He had dropped the operation for ten years and saw no need to do it as he considered washing out the cortex far more satisfactory.

Mr. FRANK G. THOMAS practised trituration in selected cases. He related one case where the patient had had defect of vision for thirteen years and was unable to work, yet the cataract showed no sign of ripening. He triturated and extracted it and six weeks after the vision was $\frac{6}{9}$. The patient, who was a ship's carpenter, returned to work in three months.

THURSDAY, JULY 28, 1904. MR. R. W. DOYNE, PRESIDENT, IN THE CHAIR.

Dr. HILL GRIFFITH opened the discussion on **Intraocular hemorrhage and systemic disease.**

He confined himself to intraocular hemorrhage in eyes otherwise free from disease, and excluded such cases as hemorrhage from accident, optic neuritis, renal retinitis, etc. Independent hemorrhage may occur from blood changes, diseased state of the finer vessels, back pressure from cardiac disease, embolism, and thrombosis.

He had never seen spontaneous hemorrhage in the anterior chamber. Of hemorrhage from the fundus, that from the retina is incomparably more frequent than from the choroid. Intraocular hemorrhage cannot be very common as in his private practice he found it in only 0.5 %.

The eighty-three cases may be grouped as follows:

Retinal hemorrhages	41
Hemorrhagic retinitis	20
So-called subhyaloid	14
Hemorrhage into vitreous . . .	8
	83

The subhyaloid variety occurred chiefly in women, and in nearly all complete restoration of sight took place.

The prognosis as to life and sight is much better in this than in any other variety of hemorrhage.

Of the cases of hemorrhage into the vitreous there is not much to be said.

Of the sixty-one cases of hemorrhage into the vitreous and of hemorrhagic retinitis, a cause was found in one-half of the cases, *e. g.*, syphilis, bronchitis, heart disease, etc. Five cases occurred in tobacco amblyopia, in seven there was marked sclerosis of the retinal arteries, and in one there was an arteriovenous aneurysm in the retina. Six out of thirty-three private cases died of apoplexy within a year. Of twenty-eight cases of embolism of the central artery, only five presented retinal hemorrhages.

He examined 500 heart cases with pupils under homatropine. Arterial pulsation was made out in ten cases only and eight of these had *aortic regurgitation.* Retinal hemorrhages were found in fourteen cases—that is, in 2.8 %, although none of the patients

was aware of any defect of sight. Details of several cases were given, and he concluded by saying that nature appears to have been able to safeguard the eye in grave disorders of the circulation but nothing like so well against changes in the blood.

Discussion on Dr. Griffith's Paper on Intraocular Hemorrhage.

Dr. LUCIEN HOWE showed the eye of a man aged twenty-eight apparently in good health. The first hemorrhage took place into the left eye in 1902 and the second two years later. Glaucoma ensued and the eye was removed in June, 1904. On section there is seen to be an extensive hemorrhage from the ciliary region. The retina is displaced, but the blood does not invade the vitreous to any extent.

Prof. UHTHOFF showed drawings and the pathological specimen of a case of preretinal hemorrhage in which the clot lies close under the membrana limitans interna. This is loosened from the nerve-fibre layer and the innermost retinal layers are pathologically changed. The position in which this is explains why there is so little tendency for it to spread into the vitreous.

Another interesting specimen was shown of an extensive hemorrhage producing detachment of the retina through a large subretinal blood-clot. Such non-traumatic hemorrhagic detachments of the retina are certainly very rare.

Dr. S. D. RISLEY (Philadelphia) related the case of a lady aged forty-five with hemorrhage into the retina near the macula. There was no evidence of any general disease or degeneration. The hemorrhage was slowly absorbed but recurred twice at intervals of twenty-eight days. A few months later she died suddenly from cerebral hemorrhage.

Dr. CHARLES A. OLIVER (Philadelphia) exhibited drawings of the ophthalmoscopic appearances and gave details of the examination of the blood in two cases of pernicious anæmia occurring in negroes. Sections showed enlarged nerve fibres with small hemorrhages, but no traces of ganglia cells were visible. He also referred to a case of splenic anæmia with characteristic ocular changes in an Italian.

Dr. GEORGE CARPENTER cordially agreed with Dr. Griffith as to the necessity of dilating the pupil for making a reliable ophthalmoscopic examination, especially in children. In cases of whooping-cough, subconjunctival hemorrhages and blood effusions into the lids were not uncommon and intraocular

hemorrhages were also sometimes seen from this cause. He looked upon such as accidental and traumatic and not systemic.

He had also seen a most extensive case of purpura follow an operation for adenoids without an anæsthetic, and in this case there were also hemorrhages into the retina, all of which were of traumatic origin. In anæmic conditions from many diseases his observations had been largely of a negative nature. He had once seen it in a case of malignant endocarditis associated with optic papillitis.

In two cases occurring in adults, one was that of an old lady who had albuminuria and arterial sclerosis, and the other that of an old gentleman whose urine was free from albumin but he had deposits of urate of soda in his ears.

Prof. HIRSCHBERG read a paper on **some practical remarks on magnet operations,** having now worked with it for twenty-five years, during which time he has done 307 operations.

He condemned the practice of placing a patient before the giant magnet in order to ascertain if a foreign body were present by the presence or absence of pain. This is liable to draw it into the ciliary body or to withdraw it together with the iris. He strongly urged the necessity of finding out for certain whether there were a foreign body present or not by means of the sideroscope or X-rays. When it is present it should, if at all practicable, be removed, and he preferred to use the hand magnet to the large one of Haab.

As a rule, it is better, he thought, to cut down exactly on the foreign body and then to introduce the point of a magnet rather than of necessity to remove it from the front of the eye or through the wound of entrance.

Should the foreign body remain in the eye it is almost certain to cause destruction of it sooner or later.

He thought that all variety of magnets were useful, but for the majority of cases he preferred the hand-magnet, although Haab's magnet has greatly increased the number of curable cases, as one is able to deal with old cases when the foreign body is imbedded.

Among 3018 cases in his own clinic he found 64 cases of iron splinters in the retina or vitreous on which he operated. Of these, 36, or 56 %, got good vision; of these about $\frac{1}{3}$ were operated upon with the hand-magnet only, $\frac{2}{3}$ with giant and hand magnet together. In 9 % the form of the globe without any

vision was saved. In most of these such extensive damage was done to the eyeball by the accident that nothing else could be expected.

Dr. BARKAN (San Francisco) entirely agreed with Professor Hirschberg as to the benefit to be obtained by the use of the sideroscope, especially with regard to the question as to whether the foreign body is inside the eye or free in the orbit.

Dr. MACKAY emphasized the gravity of the ultimate prognosis in cases where a fragment of steel is left within an apparently quiet eye. He mentioned a case in point where after the removal of a traumatic cataract the eye remained quiet for a year, an attack of irido-cyclitis came on which necessitated the removal of the eye.

Professor HIRSCHBERG, in reply, said that much harm was often done by searching for a foreign body which was really not inside the eye at all. A vertical projection of the X-rays upon the palate often was of great assistance.

Dr. RIVERS gave the results of his investigations on the comparative visual acuity of savages and civilized people. He came to the conclusion that, apart from errors of refraction, man, all over the world, had practically the same amount of vision, and in those instances in which savages appeared to possess greater visual acuity than white men, it was entirely due to practice and education and being used to their surroundings.

Dr. G. A. BERRY read a paper on the **diagnosis and treatment of glaucoma.** He said that in spite of all the work that had been done, we are still ignorant of the real nature of the disease, and we do not yet know what it is that leads to the disturbances of balance between the secretion and excretion of fluids in the eye. The discovery of the blocked filtration angle had, he thought, exercised a not altogether favorable influence on the treatment of the disease. He felt well satisfied with the result of iridectomy, though some surgeons were not too enthusiastic about it.

The diagnosis of glaucoma simplex is much facilitated by the character of the field of vision as taken with **Bjerrum's screen,** and this can be relied upon when even the tension and appearance of the disk leave one in doubt, and this result has also been confirmed by Dr. Arthur Sinclair of Edinburgh. Even the earliest stages may be detected by this method, and the mistake may by this means be avoided of mistaking a case of atrophy for one of glaucoma.

With regard to operation, there are some points that should be noted. The incision should be peripheral, yet it must not be made too far back. The author prefers to make the incision with a keratome as Graefe recommended. It is also certain that ciliary attachment of the iris could not have been removed by v. Graefe, who cut off his iris, as this could only be arrived at by tearing it away.

The use of myotics has come in since v. Graefe's time, and it is very important to know what is the result of their use in eyes that are not operated upon. His belief is that they are practically useless in glaucoma simplex, and that the most they do is to hang up the disease slightly, whereas a successful iridectomy generally cures.

The discovery of the blocked filtration angle has led operators to make desperate efforts to get the incision far back. This is a mistaken notion altogether. Even if it were possible to open up this, it would lead to cicatrization and more complete blocking than ever. This either fails altogether or leads to cystoid scars, which, although it may cure the disease, yet must be looked upon as evidence of the failure of the iridectomy.

Another result of the blocked filtration-angle discovery was the substitution of sclerotomy for iridectomy. This, however, is an altogether inferior operation and many glaucoma patients have suffered in consequence.

With a keratome he thought the incision could be made with less disturbance of the parts, and the object can be thus obtained of getting the iris away as peripherally as possible without involving the danger zone of the filtration angle. There is no need either to excise such a very wide piece of iris; a smaller piece does quite as well.

It is not unlikely that in the slowly progressive forms they do not really progress except when from some unknown cause the tension rises temporally and young people can certainly tolerate prolonged tension better than old. He concluded by saying that the only permanent results are to be got by iridectomy, that the sooner in the course of the disease it is done the better, that a keratome incision is the best, and that a very large piece of iris need not be excised.

The paper was discussed by Mr. Richardson Cross, Dr. Brailey, Mr. Wherry, Prof. Hirschberg, and Prof. Uhthoff. The last stated that he had obtained perceptible improvement

of vision in about 5 % of the cases. The condition remained stationary in about 45 %, it advanced slowly in spite of operation in about 40 %, and it was decidedly worse in 10 %.

Mr. RICHARDSON CROSS (Bristol) said that if there was any evidence of increase in the glaucoma, however slight, iridectomy was the only remedy. The difficult cases are those that were almost impossible to tell from atrophy. Instillation of cocaine may in these cases set up arterial pulsation which would be diagnostic, and wherever there is increase of tension iridectomy is indicated.

He uses a keratome and makes the incision 1½*mm* behind the corneo-scleral junction and endeavors to remove the iris right up to the periphery.

Sclerotomy is satisfactory in cases such as glaucoma in myopia, when there is no real narrowing of the angle, but an abnormality in the fluid contents of the eye.

He has some patients who have been using pilocarpine for eight or ten years without disadvantage and in some the glaucoma has been kept in abeyance.

Mr. ADAMS FROST read a paper on the **operation treatment of myopia.** There is no doubt that in suitable cases the removal of the lens for this condition gives excellent results. Suitable cases are not so often met with, and since 1896 he had operated on but thirty-nine eyes in thirty-five patients. The degree of myopia that should justify operation is one that would leave when done an ametropia of not more than 4 D; therefore, no eye should be operated upon of less than 15 D of myopia, which means that it takes a glass of 15 D to correct when placed 10*mm* from the eye. This means really a myopia of 13 D. The effect on the refraction of removal of the lens in different degrees of myopia was then discussed. With regard to fundus changes, a rough test is to find out if the patient can see J. 1 at the far point, and cases are seen in which with correction a patient could see but $\frac{6}{24}$ or $\frac{6}{36}$. Yet after the operation they could see $\frac{6}{12}$ or $\frac{6}{9}$.

The operation is usually called for in young adults. The important question remains to be decided, viz., whether the operation predisposes to detachment of the retina? The answer to this is very difficult to give, as we know so little of the cause of it and the eyes selected for the operation are those that are most likely to get it. There is the further question, viz., after what interval of time can it be said that it is independent of the opera-

tion? Among the author's cases it has occurred at intervals of 6 years, 4 years, 2 years, 8 months, 2 months, and 10 weeks, respectively. On the whole, he had a suspicion that the operation increases the liability to detachment. Among his cases, one was all right 8½ years after the operation and twelve others 5 years after, four were all right after 3 years.

Should the second eye be operated upon? On the whole, he was against doing the double operation.

Dr. LANDOLT (Paris) said that eyes that required the removal of the lens were almost always diseased and the sight much impaired. If we operate on the worse eye not much benefit will result, and if we operate on the better eye we run imminent risk. He concluded that the removal of the healthy lens was only justifiable in one of two relatively good eyes of about 20 D of myopia.

Mr. JOHNSON TAYLOR (Norwich) thought that in the operation for the removal of the clear lens multiple small punctures were safer than freely opening the capsule and subsequently evacuating the lens matter.

Mr. ERNEST CLARKE gave a résumé of twenty years' treatment of myopia in which he advocated the full correction of myopia and compound myopic astigmatism. His method is to estimate the ametropia under a mydriatic and order the full correction for all cases. In high degrees the patients sometimes refuse to accept the full correction, but with this exception he never reduces the spherical glass even for near work. Out of 532 cases who had been under observation for more than two years the majority showed no increase of the myopia, and in only three instances had the myopia increased as much as 4 D, and only sixteen had any increase worth noticing. In some it was necessary to stop all near work, but for these full correction was always given. If this were carried out generally he felt sure that progressive myopia and high degrees would become almost unknown.

Dr. ANGUS M'GILLIVRAY (Dundee) had ascertained that the temperature of the cornea was 18° F. below the body temperature, and this had an inhibitory effect upon the growth of pyogenic organisms, which as a rule flourished at the body temperature.

The closure of the lids in photophobia raised the temperature and conduced to the growth of micro-organisms. For this reason he deprecated the use of bandages in corneal lesions. To combat

the photophobia he used cocaine ointment, as this did not produce desiccation of the cornea, as did the aqueous solutions, and the eyes could by this means be kept open.

The removal of photophobia restores nictitation, and this cleanses the surface of the cornea.

In cases of wounds where closure of the lids is necessary, the temperature of the cornea should be kept down with iced compresses.

FRIDAY, JULY 29, 1904. MR. R. W. DOYNE, PRESIDENT, IN THE CHAIR.

Mr. HOLMES SPICER opened the discussion on **keratitis profunda.** He stated that many cases of interstitial keratitis were met with in which there was no trace or history of syphilis, congenital or acquired, the cause often varying or being obscure. Males are most frequently attacked, and the average age is forty. Often there is a history of alcoholism, dyspepsia, gout, rheumatism, or pyorrhœa alveolaris. A small number were in good health but with gouty family histories. Often the onset was determined by an injury, and the disease lasted about three months.

The cornea is affected in two ways, either a central disk of opacity or else a peripheral cone with formation of new vessels. Striate keratitis is nearly always present in the early stages but soon gives way to a uniform opacity. The corneal surface always becomes œdematous. If fluorescin is put into the conjunctival sac, it is absorbed into the eye and the deeper layers of the cornea become stained and also the endothelium. Sometimes this staining is patchy and punctate. Iritis is present in about one-quarter of the cases, and cyclitis is shown by the presence of keratitis punctata in nearly one-half.

The primary cause is disease of the blood-vessels, and if they are ligatured the endothelium is shed and the aqueous soaks into the cornea and produces œdema and striate keratitis on its posterior surface, and cellular infiltration of the cornea itself.

The local treatment consists of hot fomentations and atropine, and if the tension be raised paracentesis should be done. Iridectomy or peritomy is generally harmful. Subconjunctival injections are useless and irritating. The underlying constitutional condition should be determined and treated. This is of the greatest importance.

Discussion on Mr. Spicer's Paper on Keratitis Profunda.

Mr. POWER pointed out that cases of deep-seated keratitis presented considerable variations in their course and termination. Some strumous cases quickly passed into suppuration. He gave an instance which caused the sight to be reduced to light perception only. Iridectomy in one eye did no good and the child was regarded as permanently blind. In the course of many months clearing took place and the child can now see to read. He mentioned other cases associated with general debility.

Mr. CYRIL WALKER (Bristol) commented on the frequency of interstitial keratitis in Bristol which did not follow the usual course. He instanced two cases associated with pregnancy which left a pyramidal opacity in both eyes. He asked if exposure to cold was considered a frequent cause of deep-seated keratitis.

Mr. GRAINGER (Chester) said that most of the cases he had seen occurred between the ages of thirty-three and thirty-eight and women were more frequently attacked than men.

From its course and result he looked upon it as quite apart from ordinary interstitial keratitis. The progress is always slow and there are punctate opacities in about one case in four. The regular use of dionin has given very satisfactory results.

Dr. CARL KOLLER said that in the acute stages his treatment was much the same as most people's, viz: atropine, hot fomentations, etc., but in the later stages he uses pot. iod. internally and yellow precipitate ointment locally. Now this causes great reaction as iodide of mercury, which is an irritant, is found in the tissue. Great reaction takes place at first, but toleration is established and the cornea clears.

Lately he has used 5 % dionin and could testify with Mr. Grainger as to its usefulness. He uses it alternately with the preceding.

Dr. HILL GRIFFITH asked whether anæsthesia of the cornea had been tested, and whether Mr. Spicer looked upon it as a primary lesion of the blood-vessels of the uveal tract, especially of the ciliary body, and whether any fundus lesions were found when the cornea had cleared.

Dr. CARL KOLLER read a paper on the **subconjunctival injection of cocaine in the extraction of cataract.**

It is now twenty years since it has come into general use, and owing to the iris remaining sensitive, he soon began to discard the method of instillation only, and to inject it subconjunctivally.

This is his method: First a few drops are instilled into the conjunctiva. After two minutes two or three drops of a 5 per cent. solution are injected beneath the ocular conjunctiva at the point where the fixation forceps are to grasp; one must be careful not to inject it into the episcleral tissues but simply beneath the conjunctiva. An interval of five or six minutes should now ensue while the eye is covered with a wet pad. The pupil will now be dilated, and the operation may be performed entirely painlessly. In glaucoma, if the eye is inflamed, he uses a general anæsthetic, but if not a mixture of cocaine and pilocarpine with the subconjunctival injection of cocaine is quite satisfactory, and it has no drawbacks.

Dr. HILL GRIFFITH asked if Dr. Koller had used it for enucleation of the eyeball; he had on one or two occasions done it himself without a general anæsthetic, and had even done it before the days of cocaine without the patient showing much sign of pain or shock.

The PRESIDENT said he had frequently removed eyes under cocaine with excellent results, but Dr. KOLLER said he always used a general anæsthetic for this operation.

Dr. LUCIEN HOWE (Buffalo) demonstrated a method of determining the **rapidity of the lateral motions of the eye.** This was done by reflecting a bright arc light on to the cornea and then as the eye was swung from one side to the other the corneal reflex was made to focus on to a photographic film in a camera. At the same moment the time was measured by the vibrations of a tuning-fork, and these were also photographed.

The point of practical importance is to determine the time the eyes take to swing inwards or outwards and the length of the interval between the two motions. The simplicity of the apparatus, compared with that used by other observers to determine the same thing, is the chief feature about the communication.

Dr. M'GILLIVRAY asked if Dr. Howe had made observations on eyes which had had advancement or tenotomy done.

Dr. HILL GRIFFITH asked if Dr. Howe had tried it in alcoholics, and whether the motions of the eyes thus graphically recorded could be used as legal evidence of sobriety or the reverse.

Dr. HOWE said that he had measured the movements of the eyes after squint operations, but not in cases of alcoholism, which would be most difficult to do.

Mr. WATSON GRIFFIN (Hove) showed a **modified Bowman**

suction syringe that he had invented for the purpose of removing broken-up lens matter from the anterior chamber. It consists of an ordinary syringe whose piston was kept out by means of a spring; this was compressed and then allowed to gently come out by relaxing the pressure on the spring. It was cheaper and more efficient than the ordinary suction syringe of Bowman.

Professor HIRSCHBERG gave an historical account of suction operations on cataracts.

Dr. JAMES HINSHELWOOD (Glasgow) described a case of **word-blindness with slight homonymous hemianopsia.** The patient was a man aged fifty-eight, a teacher of languages, who was first seen on August 29, 1894. About a month previously he was startled to find that he could not read a French exercise which a pupil gave him to correct, and he then found he could read nothing. This condition remained. It was found he could see the letters quite well, but could not name them. He could, however, read figures perfectly correctly, and there was no lowering of the visual acuity. He could name objects and pictures of objects quite correctly, and could write to dictation with perfect ease, though he could not afterwards read what he had written. No other mental defect could be ascertained, and his speech and memory were excellent. The perimeter showed right lateral homonymous hemianopsia. The fundi were normal and general health was good. After six months' daily practice he began to recognize letters but never learned to read. The effort was so great that he eventually gave it up. Eight years later he had again lost the visual memory of letters. Up to his death in August, 1903, his symptoms remained the same, and nothing new developed during the nine years he was under observation. He died quite suddenly. On post-mortem examination a recent hemorrhage was found in the right cerebellar lobe. On the inferior aspect of the left occipital lobe was a triangular area of sunken and atrophied appearance, the pia mater forming on this the outer wall of a cyst from which, on puncture, two or three drachms of clear fluid escaped.

The left lateral ventricle was widely dilated, and this practically replaced the lower half of the occipital lobe. The cause of this was probably thrombosis.

This case throws much light on the subject of word-blindness and indicates very precisely the situation of these centres. The paper is most exhaustive and should be consulted by all those interested in the subject.

Dr. HINSHELWOOD also read a paper on a case of **congenital word-blindness.** The patient was a boy aged twelve who was first seen in March, 1902. He had been at school seven years, and there had been from the outset the greatest difficulty in teaching him to read. He made no complaint of his vision. His refraction and eyes were normal, and in all other respects he was a quick and intelligent boy and had no difficulty whatever with arithmetic, and could read all combinations of figures, but he could not read more than the simplest words by sight, and not always then unless he was allowed to spell them. By taking him out of the class and giving him short lessons alone he made excellent progress. As this is the fifth case Dr. Hinshelwood has recorded, he thinks they are not really so rare but they are unrecognized.

The cause of this is now pretty generally agreed to be a defect in the angular gyrus of the left side. In nearly all these cases the difficulty is got over by perseverance, though such children cannot be taught in class, and many short lessons with a teacher are far better than one long one.

Dr. WILFRID HARRIS said that the first case recorded by Dr. Hinshelwood seemed to show that the function of the angular gyrus is really concerned with the visual memory of words alone, and that only the left angular gyrus is thus important in right-handed people.

Mr. BISHOP HARMAN said that he was surprised at the author's belief that the condition was rarely recognized by surgeons. It was so well recognized that the London County Council provided "special schools" for them, and in the report Dr. James Ker gave details and specimens of handwriting, etc., of those who had been taught in the special ways necessary. He thus considered that the much-maligned English educational system was in this respect ahead of the Scottish.

Dr. HINSHELWOOD, in reply, said he was glad to find that his work had been so well recognized that now ophthalmic surgeons did recognize these cases. His case gave most important pathological confirmation to the views of Dejerine and Serieux.

Dr. GEORGE CARPENTER read a paper on **albuminuric retinitis in a case of parenchymatous nephritis in a child.** Chronic interstitial nephritis in children is a rare condition, but nothing like so rare as is usually supposed.

The child whose case he now brought forward was a girl aged ten years who was first seen in November, 1885. Her illness

commenced in June, 1884, with headache and abdominal pains followed by sickness. She had five of these attacks in a fortnight. Blood appeared in her urine on November 7, 1885, and since then has been noticed in varying quantities. She passed only about one pint in twenty-four hours, and this contained about ⅛ albumin. She had neuro-retinitis in both eyes. The eye changes were minutely described and drawings of the condition shown. During December, 1885, and January, 1886, she passed about two pints daily, and the most albumin it ever contained, when not obviously containing blood, was ¼. Abdominal pains recurred frequently, and on April 8, 1886, the urine was nearly solid on boiling. Some œdema was then noticed about the ankles. The parents then suddenly determined to remove her from the hospital, and she died very soon afterwards. The doctor who attended her at home removed the kidneys; they were of the "large white" variety, and the pelvis and ureter were enlarged and thickened.

Mr. Bishop Harman read a paper on **the lymph follicles in (apparently) healthy conjunctivæ.**

The presence of lymph follicles in the conjunctiva is of importance chiefly from the close resemblance it has to trachoma, for which it is sometimes mistaken. He went carefully into their anatomical structure and mentioned how extremely common it was to find them quite visible to the naked eye.

In an extremely sanitary and healthy district in the northeast of London, in which there were no aliens, he carefully examined the school children, and amongst them almost every condition of follicle could be found, and all of them showed no sign of conjunctival disease. Of 1011 children, 58 % had follicles. From the ages of three to nine the girls and boys are almost equally affected, but at the tenth year onwards the girls show about 30 % more cases than the boys, and this continues to the end of school life.

It was then noticed that the incident of the presence of nits in the hair was similar to that of the follicles in the girls.

This is to be explained by the fact that about the age of ten the girls begin to take their share in domestic work, and as a result are left to themselves to look after their personal cleanliness; this they neglect and their health suffers, nits become more frequent, and the follicles in the conjunctiva become more apparent. It is too early for the onset of puberty to have any effect.

Some of those who have the largest follicles get quite well with

mild remedies, and severe treatment leads only to scarring and permanent damage. These cases are exactly analogous to the enlargement of the tonsils and to the hypertrophy that produces adenoids. These cases are not contagious, but the general health is usually affected and so they may fall victims to any virus that may be about, and a simple catarrh may give the case a most serious aspect.

Of twelve cases examined bacteriologically, the author found the Koch-Weeks bacillus twice, the Morax bacillus once, streptococci once, and staphylococci three times. They all made a rapid recovery.

The conclusion is that the diagnosis of follicular conjunctivitis is defective.

Dr. C. H. BURNHAM (Toronto) read a paper on the **combined treatment of diseases of the eye,** especially in that of the uveal tract. This treatment consists of the internal administration of mercury and iodide of potassium with the hypodermic injection of pilocarpine. The details of this treatment, which he has been using for fifteen years, have been published elsewhere. He gave examples of various diseases of the eye, especially of sympathetic disease, that had greatly benefited by its employment.

Dr. ADOLPH BRONNER (Bradford) read notes of a case of **thrombosis of the cavernous sinus due to empyema of the sphenoidal sinus.** There were no symptoms to account for its origin except anæmia, which had existed for several years. The patient was a stout but anæmic girl who had been quite well up to February 24th, when she had some headache. On March 1st there was slight swelling of the right eyelids and some proptosis. On March 5th there were ptosis and chemosis, and eye movements limited. Temperature 101°. Next day she was worse, temperature 103.6°. There was no papillitis, but the veins were swollen. On March 13th, temperature was 106°. She gradually got worse and died on March 31st. On post-mortem examination, both cavernous sinuses were thrombosed and filled with pus, and so were most of the other intracranial sinuses.

Both sphenoidal sinuses were full of pus and granulation tissue, and this was evidently the starting-point of all the mischief. This is very rare and the entire absence of symptoms is remarkable.

The injection of anti-streptococcus serum did no good, but, if anything, made matters worse. He expressed the hope that this case would induce surgeons in cases of obscure optic atrophy to carefully examine the nose and the sinuses.

SYSTEMATIC REPORT ON THE PROGRESS OF OPHTHALMOLOGY IN THE THIRD QUARTER OF THE YEAR 1903.

By Dr. G. ABELSDORFF, in Berlin; Prof. ST. BERNHEIMER, in Innsbruck; Dr. O. BRECHT, Prof. R. GREEFF, Prof. C. HORSTMANN, and Dr. R. SCHWEIGGER, in Berlin:

WITH THE ASSISTANCE OF

Prof. A. Alling, New Haven; Prof. E. Berger, Paris; Prof. Cirincione, Genoa; Dr. Dalén, Stockholm; Prof. Hirschmann, Charcow; Dr. J. Jitta, Amsterdam; Mr. C. Devereux Marshall, London; Dr. H. Meyer, Brandenburg; Dr. P. von Mittelstädt, Metz; Dr. H. Schulz, Berlin; Prof. Da Gama Pinto, Lisbon; and others.

Translated by Dr. Ward A. Holden.

Sections XIII.–XVIII. Reviewed by Dr. O. BRECHT, Berlin.

XIII.—LENS.

382. **Uhthoff.** Cataract with a simultaneous tetanoid condition. *Deutsche med. Wochenschr.*, 1903, Vereinsbeilage, p. 269.

383. **Feilke.** A case of removal of a splinter of iron from the lens with preservation of its transparency. *Arch. f. Augenheilk.*, xlviii., p. 242.

384. **Pagenstecher, A. H.** On cataract operations with special reference to after operations. *Zeitschr. f. Augenheilk.*, x., p. 206.

385. **Elliot.** An analysis of a further series of 250 consecutive operations for primary cataract performed in the Government Hospital, Madras. *Lancet*, May 2, 1903.

386. **Ramsay, A. Maitland.** Case of a man blind from congenital cataract who acquired sight after an operation when he was thirty years of age. *Ibid.*, May 16, 1903.

387. **Keefer.** Complete absorption of an injured crystalline lens in a man of forty-six years. *Ophth. Record*, Aug., 1903.

Cases of injury of the lens with but partial opacity are infrequent. FEILKE's (383) case was one of injury with a splinter of iron at the anterior pole of the eye in a patient aged twenty-three. A magnet extraction was done three hours later. Miotics were used and a binocular bandage was kept on for a week. Eight months later there was a small circumscribed opacity of the anterior cortical substance, with the remainder of the lens clear. V = $\frac{5}{7.5}$, uniocular diplopia. With a stenopaic slit V = $\frac{5}{5}$. The favorable outcome was supposed to be due to the treatment with miotics and the abolishing of accommodative efforts by the employment of the occlusive bandage.

PAGENSTECHER (384) described the usual procedure in operations for cataract and secondary cataract followed in the Pagenstecher private clinic. Attention is called to the fact that the operated eye is covered with a pad of gauze soaked in liquid paraffin on which pure ichthyol is spread. The course of healing is free from irritation. In the after operation the thinnest part is cut through in order to avoid traction on the ciliary body.

The patient seen by RAMSAY (386) was a man aged thirty, who was born blind. The eyes were small and the lenses opaque. Projection and light perception were perfect. Ramsay removed the cataracts from both eyes. At first the patient was dazed as if incapable of recognizing what he saw. The first color he could recognize was red. The most difficult color to recognize was green, and yellow he found so disagreeable that the sight of it nearly made him vomit. From the first he saw everything in its actual position, thus showing that the retinal inversion of an image is interpreted psychically without any education. Size and distance were estimated better than might have been expected. The fundi appear to be normal.

MARSHALL.

XIV.—IRIS.

388. **Sartorius.** Report on ten cases of tuberculosis of the iris. *Inaug. Dissert.*, Giessen, 1903.

389. **Grut, E. H.** On iridectomy. *Hospitalstid.*, July 24, 1903.

390. **Schoute.** A case of cinchonin intoxication. *Weekblad. v. h. Nederl. Tijdschr. v. Geneesk.*, No. 1, 1903.

SARTORIUS (388) confirms the opinion of v. Michel that tuberculosis of the eye is more acute in youth than in adult age,

and also the view of Haab that the upper portion of the iris usually is free from tubercles (in nine out of ten cases). In two of his cases the process led to the formation of staphyloma.

GRUT (389) believes that optical iridectomy is much misused. In dense leucomas it is useless, in fainter leucomas it is usually of no value because of the irregular refraction of the periphery of the cornea. The coloboma often rides over the margin of the lens. In an optical iridectomy the margin of the iris should be left. Iridectomy for lamellar cataract, is as a rule, useless and discission gives better results.

Iridectomy is sometimes done for recurrent iritis, but the writer agrees with Hirschberg that the subsequent attacks are often worse than the others. Iridectomy for staphyloma brings about an apparent improvement immediately after the operation, but the late results are not satisfactory.

Iridectomy in cases of embolism of the central artery is valueless and the usefulness of preparatory iridectomy in cataract is questionable. Iridectomy is made sometimes in cases of punctate keratitis with increased tension, but this condition is usually found in the young who bear an increased tension well. Iridectomy must be done in the acute and chronic congestive forms of glaucoma, but the results in simple glaucoma are difficult to judge of. The writer's results have not been encouraging.

In cases of buphthalmus, iridectomy is preferable to sclerotomy.

DALÉN.

XV.—CHOROID.

391. **Cuperus.** On primary atrophy of the choroid with sclerosis of the vessels—"Atrophia alba chorioideæ." *Arch. f. Augenheilk.*, xlviii., p. 235.

392. **Bruner, W. E.** Sarcoma of the choroid in a child. *Ophth. Record*, July, 1903.

CUPERUS (391) describes a condition which he calls atrophia alba chorioideæ.

The patient, a man of seventy, in comfortable circumstances, had noticed a failure of vision for thirty years. No history of syphilis or alcoholism, slight arterio-sclerosis. R, V = $\frac{9}{60}$; L, V = $\frac{1}{60}$, large central scotoma, normal limits of fields, no hemeralopia. At the posterior pole a whitish discoloration over which the vessels of the chorio-capillaris ran as chalky-white lines extended from the disk out beyond the macula. There were many black pigment spots in the retina. The optic disk

was pale gray, sharply outlined, and excavated in its entire extent. The retinal arteries were narrow. The author believes that the affection had begun thirty years before as a primary atrophy and sclerosis of the choroid and had led to atrophy of the retina and optic nerve. A brother of the patient, seventy-three years old, suffered, according to Dr. van der Meer, from the same affection.

The case of BRUNER (392), which he does not show to have been other than glioma, was first seen at the fourth stage in a child of six years. Enucleation and complete exenteration of the orbit were performed. There was no recurrence in the orbit, but the child died of metastatic growths which appeared in the temple and jaw. ALLING.

XVI.—VITREOUS.

393. **Hillers.** A contribution to the subject of embryonic tracts in the vitreous (hyaloid artery, Cloquet's canal), with an anatomical report of one case. *Inaug. Dissert.*, Giessen, 1903.

394. **Reis.** A contribution to the subject of congenital connective-tissue formations in the vitreous. *Klin. Monatsbl. f. Augenheilk.*, xli.

HILLERS (393) reports ten cases of tracts in the vitreous—nine being hyaloid arteries, and one a visible Cloquet's canal. In one case blood corpuscles could be seen in the hyaloid artery, and in another case there were opaque nerve fibres.

REIS (394) describes in detail two cases of thickening and persistence of the connective tissue about the fœtal artery in the vitreous, one case having also a coloboma of the nerve sheath. In a third case there was a connective-tissue diaphragm in the vitreous, with a large coloboma of the fundus in the left eye, and a coloboma of the macula in the right.

XVII.—GLAUCOMA.

395. **Holmström.** The classification of glaucoma. *Hospitalstid.*, July 8, 1903.

396. **Engel.** The late results of glaucoma operations. *Inaug. Dissert.*, Strassburg, 1903.

XVIII.—SYMPATHETIC OPHTHALMIA.

397. **Roemer.** Studies in sympathetic ophthalmia. II. Experimental investigations on the transference of irritation, and on disposition to sympathetic ophthalmia. *Graefe's Archiv*, lvi., 3, p. 439.

ROEMER (397) showed by his experiments on rabbits and

monkeys that a transference of ciliary irritation in a reflex manner does not take place, and that a disposition to the development of sympathetic ophthalmia cannot be brought about by irritation of the ciliary nerves of the first eye.

Sections XIX.–XXII. Reviewed by DR. H. MEYER, Brandenburg.

XIX.—RETINA AND FUNCTIONAL AFFECTIONS.

398. **Schmidt-Rimpler.** The color of the macula lutea. *Graefe's Archiv*, lvii., p. 24.

399. **Ahlstrom, G.** On hemorrhagic retinitis. *Annales d'ocul.*, cxx., p. 150.

400. **Knape.** On pigmentation of the retina, proceeding from the vitreous, and on typical retinitis pigmentosa. *Arch. f. Augenheilk.*, xviii., p. 314.

401. **Jessop, W. H. H.** Some points in the pathology and prognosis in glioma of the retina, with cases. *St. Bartholomew's Hospital Reports*, 1902.

402. **Hudson, Ainslie.** Notes on a case of congenital night-blindness. *The Ophthalmoscope*, 1903.

403. **Lister, W. T.** Angioid streaks in the retina. *Ophth. Review*, June, 1903.

404. **Pyle, W. L.** An interesting case of pigmentary degeneration of the retina (retinitis pigmentosa). *Amer. Medicine*, August 8, 1903.

405. **Hurd** and **Holden.** A case of paraffin injection into the nose, followed immediately by blindness from embolism of the central artery of the retina. *Med. Record*, July 11, 1903.

At Heidelberg, in 1902, Gullstrand expressed the opinion that in the detached retina of an eye examined immediately after enucleation no difference could be found between the color in the region of the fovea centralis and that of the other portions of the retina. SCHMIDT-RIMPLER (398), however, refers to the fact that in his investigations, in 1875, he found the fovea yellow in the fresh retina, and refutes Gullstrand's opinion that the failure to strip off the pigment epithelium caused an error of observation. The yellow color itself causes the darker shade in the fundus, and not the more marked retinal pigmentation. The portions of the retina about the macula in retinas removed from ten freshly enucleated eyes and left for a longer or shorter time in salt solution kept the yellow color. When the retina becomes entirely cloudy and opaque, the lemon-yellow color is seen in the entire retina.

AHLSTROM (399) examined, anatomically, an eye with hemorrhagic retinitis. He found thickening and hyaline degenera-

tion of the walls of the arteries, and capillaries in the retina and optic nerve. He believes that hemorrhagic retinitis is caused by arterial disease quite as frequently as by venous thrombosis from phlebitis proliferans of the central vein as described by v. Michel.

BERGEN.

KNAPE (400) describes a case of total detachment of the retina due to myopia. In the course of years a gradual pigmentation of the retina was observed, when the onset of a chronic iridocyclitis prevented a further view of the interior. Only the posterior half of the ball was obtained for anatomical examination. In it he found immigration of pigment into the lymph spaces and ciliary vessels, and absence of a large portion of the capillaries of the choroid, and the remaining vessels exhibited endarteritis obliterans.

The pigment epithelium of the choroid was degenerated in high degree, and the fuscin bodies had wandered out. The nervous elements of the retina had vanished, and the membrana limitans interna and externa were partly destroyed. A mass of black pigment lay on the limitans interna, and a brown pigment had broken through the outer layer of the retina from the choroid.

In this case, pigment from the ciliary body passed through the vitreous into the retina. On the ground that endarteritis obliterans was found in this case, the author gives his views of the etiology of typical retinitis pigmentosa as follows : The cause of retinitis pigmentosa lies in a congenital anomaly of development of the choroidal vessels predisposing them to endarteritis obliterans. An exciting cause, such as eye affections of various sorts, fevers, syphilis, and the like, then brings on the disease. The essence of the disease is an endarteritis of the smallest capillaries behind the ciliary body which, by affecting the nutritive processes, leads to a slow atrophy, proceeding from the periphery toward the centre of the retina, and a secondary inwandering of pigment into the retina.

JESSOP'S (401) paper formed the Presidential Address of the Ophthalmic Section of the Cheltenham Meeting of the British Medical Association, 1901. Six cases are described and the paper is illustrated by photomicrographs. There is an extensive bibliography at the end of the paper. MARSHALL.

The patient here described by HUDSON (402) is a man aged twenty-two, who suffered from night blindness. There was also

a history of other members of the family being affected. On ophthalmoscopic examination it was found that there were no signs of retinitis pigmentosa, but the case was evidently of this nature but without the usual pigmentary changes.

MARSHALL.

LISTER (403) excludes all cases of inflammatory origin, and takes only those cases which are bilateral. The histories are of no special interest, and the vision varies considerably.

The streaks lie external to the retinal vessels and there is generally a more or less circular band near the disk. The streaks do not correspond to the retinal or choroidal vessels.

He then gives Knapp's and other observers' views as to their origin, and describes two cases he has examined histologically. These showed degeneration of the retina and the rods and cones had disappeared. At the point corresponding to the most marked streak, the retina was detached, and the granular deposit was present. In this were several blood-vessels, and bone formation was commencing. The other specimen showed somewhat similar changes.

In both he is in doubt as to the origin of the new-formed vessels, as they correspond neither to retinal nor choroidal ones. It seems probable that they have two sources, viz.: from the vessels of the ciliary body and from those of the optic nerve. These vessels are in the deeper layers of the retina, and they appear essential factors in a system of pigmented striæ similar in level and in many ways in appearance to those seen in cases of angioid streaks. The cause is a chronic inflammatory process, and it is probable that some of the retinal hemorrhages may occur from these vessels. MARSHALL.

The points of interest in the case of PYLE (404) are a complete family history which showed no serious eye diseases or consanguinity, and the fact that serviceable vision was retained after so many years—the patient being fifty-four. There was contraction of the field of vision to about 5° from the fixation point. Color perception was preserved. ALLING.

The common practice of injecting hot paraffin into the tissues to correct deformities, especially of the nose, is not without danger, as would appear from the case related by HURD and HOLDEN (405). The patient had a saddle-shaped nose, and two injections had already been made. After the third he immediately became blind in one eye. The ophthalmoscopic picture showed the

characteristics of embolism of the central artery of the retina. Treatment with massage and heart stimulants was of no avail, and the vision was not restored. It is known that a few fatal cases have occurred after these injections, but the record of only one other case of blindness was found by the authors. It is difficult to explain how the embolus reached the eye unless possibly on account of a persistent foramen ovale, through which foreign bodies entering a vein might pass directly into the main arterial system without passing through the capillaries of the lungs.

ALLING.

XX.—OPTIC NERVE.

406. **van Geuns.** A case of new formation of an optico-ciliary vein in consequence of choked disk. *Arch. f. Augenheilk.*, xlviii., p. 247.

407. **Alexander.** A further case with an arterial loop passing out into the vitreous. *Zeitschr. f. Augenheilk.*, x., 3, p. 188.

408. **Dyckmeester.** A case of pigmentation of the optic disk. *Arch. f. Augenheilk.*, xlviii., p. 55.

409. **Terson.** The emergency treatment of amblyopia following loss of blood. *Soc. d'opht. de Paris*, July 8, 1903.

410. **Pasteur, W.** Cerebro-spinal meningitis and optic atrophy with complete loss of sight, followed by partial recovery of vision of unusual character. *Brit. Med. Journ.*, March 7, 1903.

411. **Wingrave, Wyatt.** Tobacco deafness. *Med. Press and Circular*, Feb. 11, 1903.

412. **Taylor, James.** Concerning some unusual forms of optic atrophy. *The Ophthalmoscope*, Sept., 1903.

To the many cases of optico-ciliary veins on record, VAN GEUNS (406) adds a new one in which the anomaly was present in the disk in each eye. The patient had bilateral optic-neuritis, probably from brain tumor. Vision remained R ½, L 1. The optico-ciliary vein of the right eye developed in the course of three months. But the veins disappeared six months later with the onset of atrophy.

According to the author, this case supports the view that optico-ciliary veins in eyes with vascular stasis represent new-formed anastomoses. The existence of a collateral venous outflow is shown by the fact that vision remained nearly normal throughout nearly the entire period of observation.

In conclusion the author states that he distinguishes two sorts of optico-ciliary veins. The first sort is that which as in the case described above, arises as a dilated anastomosis in an eye with stasis in the central vein. The other sort is congenital—a

variation of the venæ vorticosæ chorio-vaginales, for which he proposes the name cilio-optical or chorio-optical.

In ALEXANDER'S (407) case, the inferior nasal artery of the retina immediately beyond its origin in the disk passed forward into the vitreous and forming a double loop passed back to be distributed through the usual portion of the retina. The author regards this anomaly as being analogous to the arterial loops that are sometimes found in the level of the retina.

DYCKMEESTER (408) reports a case of congenital pigmentation of a disk with an excavation. He agrees with Pick that the pigmentation is due to the fact that the excess of pigment of the disk in embryonic life has not been fully absorbed. The excavation of the disk is not explained.

TERSON (409) has in an earlier paper called attention to the necessity of early injections of blood serum in cases of amblyopia after the loss of blood. Berger had previously recommended the same treatment. Terson now reports a case observed by Poinat—that of a woman who lost much blood after the removal of an adherent placenta and her vision became reduced to perception of light; 4*cc* of artificial blood serum was injected and the following day vision was normal again. BERGER.

PASTEUR'S (410) patient was a woman aged twenty-two, in whom the loss of sight was apparently due to pressure on the optic nerves. She could see lights and objects, but that perception was only momentary, and immediately was lost unless the light were moved, whereas her perception of the hand gained in distinctness as she continued to look at it. MARSHALL.

Of seventeen cases of symmetrical nerve deafness described by WINGRAVE (411) as being due to tobacco, twelve showed marked impairment of color-sense; of the latter, four had well-marked central scotoma. The deafness he believes is due to certain toxines of the tobacco, and he thinks that the abuse of tobacco leads to a selective degeneration in the auditory as well as in the optic nerve. MARSHALL.

TAYLOR (412) discusses various of the more uncommon forms of optic atrophy which are associated with various diseases. He refers to several forms associated with organic diseases of the central nervous system as well as those forms seen with tobacco amblyopia, glycosuria, tumor of the pituitary body, and also cases of Leber's atrophy. MARSHALL.

XXI.—INJURIES, FOREIGN BODIES, PARASITES.

413. **Sidler-Huguenin.** An injury of the eyes in birth. *Corr.-Bl. f. Schweizer Aerzte*, 1903, No. 6.

414. **Weinstein.** Experimental investigations on the process of healing after perforating wounds of the cornea. *Arch. f. Augenheilk.*, xlviii., p. 1. To be translated.

415. **Lange.** On traumatic cysts of the bulbar conjunctiva and on the prognosis and therapeutics of infected injuries of the eye. *Klin. Monatsbl. f. Augenheilk.*, xli., 11, p. 199.

416. **Schmidt-Rimpler.** On magnet operations on the eye. *Arch. f. Augenheilk.*, xlviii., p. 183.

417. **Feilke.** A case of removal of a splinter of iron from the lens with preservation of its transparency. *Ibid.*, p. 242.

418. **Genth.** A case of double perforation of the eyeball by a splinter of iron. *Ibid.*, p. 275.

419. **Ewart, J. H.** Large piece of glass embedded in the orbit for twenty years without symptoms. *Lancet*, Aug. 1, 1903.

420. **Deane, L. C.** Localization of foreign bodies in the eye and their removal. *Amer. Jour. Med. Sciences*, July, 1903.

Sidler-Huguenin (413) reports six cases of ocular injury at birth. In one case with a normal pelvis and normal labor, a right-sided facial paralysis developed, while the other cases were of ocular injury after forceps delivery. The injuries consisted of hemorrhages in the conjunctiva, anterior chamber, and retina, in corneal opacities of long duration, in compression of the face and exophthalmus with extrusion of the eye from the orbit. According to the writer, the use of the forceps cannot be the sole cause of the injury, since in three cases the cornea was more or less cloudy. It seems reasonable to consider the disturbances of circulation the cause of the injury rather than the direct pressure of the forceps upon the eye. In two cases the statements of the obstetricians showed that the forceps could not have compressed the eye directly.

It is interesting to note that the most varied changes in the eye are observed after normal but prolonged labor, even when no artificial aids are employed. The mechanism of the injuries is not wholly clear. The author believes that the pressure upon the body during birth leads to extreme tension in the vessels of the head; and the sudden interruption of the fœtal circulation may lead to transitory disturbances of circulation.

Lange (415), in support of the idea that trauma is an etiological factor in the production of conjunctival cysts, reports a case

of injury of the right eye with a corkscrew. In the upper nasal quadrant of the ball, an elastic tumor 10*mm* long by 8*mm* broad had developed at the injured spot and unfortunately an anatomical examination could not be made. In explanation of its development, Lange suggests that the instrument tore off epithelial cells from the surface and carried them into the subconjunctival tissue, where by proliferation they produced a cyst.

SCHMIDT-RIMPLER (416) describes his experience with the magnet operation, based on thirty-eight cases with 92 % of positive results. In six cases extraction through the entrance opening was possible, in three a peripheral corneal incision was made. In the others the bulging iris was excised before the extraction. Half of the patients obtained useful vision, fourteen had vision better than $\frac{1}{3}$, and of the latter five had perfect vision. As a rule, the author brings the splinter with Haab's giant magnet through the zonula behind the iris, excises the bulging portion of the iris, and removes the body from the anterior chamber with the small Hirschberg magnet. When this method cannot be followed, a scleral section is made and the hand magnet used. Since the giant magnet often becomes hot, he believes that the thick magnet is preferable to the thinner magnet of Volkmann. Stress is laid upon approaching the eye to the magnet gradually and upon illuminating the iris with an electric light in order to observe the bulging. The result depends upon the size of the foreign body and the absence of infection and hemorrhage into the vitreous.

For diagnosis he prefers the Dörffel-Hirschberg sideroscope. Pain when the eye approaches the magnet is evidence of the presence of a foreign body. The contrary, however, is not true.

FEILKE (417) reports a case of injury with a splinter of iron, in which, notwithstanding extensive opening of the anterior capsule of the lens and the fact that the foreign body remained long in the cortex, no particular swelling of the lens occurred. After removal of the foreign body, the wound healed without swelling of the lens fibres. Removal was accomplished by a combined method—the employment of Schlösser's magnet and extraction from the anterior chamber by means of Hirschberg's electromagnet. The favorable recovery was secured by using a double bandage for a week, thus preventing accommodative efforts, and the continued use of miotics.

GENTH (418) adds another to the few cases observed of double perforation of the ball. In this case the cloudiness of the lens

was so slight that the point of exit could clearly be seen. The X-rays should be used to make the diagnosis, but an important diagnostic symptom is the reduction of tension.

The piece of glass removed by EWART (419) measured 3*cm* long, 1*cm* in breadth, and 1.75*mm* in thickness. It had remained in the orbit for twenty years and was the result of her breaking a clock glass. The wound was sewn up, but the foreign body was not detected. MARSHALL.

DEANE (420) uses the localizer of Davidson. He reports the histories of seven cases of foreign body in the eye and appends radiographs and diagrams to show the position of the objects. ALLING.

XXII.—OCULAR DISTURBANCES IN GENERAL DISEASES.

421. **Bentzen.** Ocular affections in cases of lupus vulgaris. *Hospitals-tid.*, July 8, 1903.

422. **Natanson.** Hemorrhagic retinitis in cancer of the lungs and cerebellum. *Klin. Monatsbl. f. Augenheilk.*, xl., 2, p. 101.

423. **Collomb** and **Müller.** On a case of uniocular metastatic ophthalmia with abscess of the arm, of puerperal origin. *Rev. méd. de la Suisse romande*, 1903.

424. **Asmus.** Observations on acute cases of sclero-keratitis rheumatica. *Klin. Monatsbl. f. Augenheilk.*, xli., 2, No. 7.

425. **Rogman.** Intraocular tuberculosis. Dangers of enucleation. *Ann. d'ocul.*, cxxx., p. 65.

426. **Morax.** On some ocular manifestations in the course of measles. *Ibid.*, cxxx., p. 104.

427. **Janet.** A disturbance of vision from exaggeration of binocular association. *Ibid.*, cxxx., p. 29.

428. **Lechner.** Congenital word-blindness. *Ned. Tydschr. v. Geneesk.*, 1903, ii., No. 5.

429. **Schoute.** A case of cinchonine intoxication. *Ibid.*, No. 5.

430. **Dodd** and **McMullen.** A case of congenital deformity of the skull associated with ocular defects. *Lancet*, June 13, 1903.

431. **Zimmermann** and **Pusey.** Clinical and histological report of a case of purulent metastatic ophthalmia in meningitis, giving rise to meningitic and sympathetic symptoms after thirteen years. Enucleation. Recovery. *Annals of Ophth.*, July, 1903.

432. **Gilfillan.** A case of panophthalmitis in typhoid fever. *Med. News*, July 25, 1903.

433. **Baker.** Eye complications of small-pox. *Jour. Amer. Med. Assoc.*, Sept. 12, 1903.

BENTZEN (421) found among the 1000 patients with lupus treated in Finsen's light institution 368 with some affection of

the eye as follows: blennorrhœa of the lachrymal sac, 153; keratitis, 141; ectropion, 31; and lupus of the conjunctiva, 9.

In the last two years the number of lupus patients who seek relief from eye affections has become much less, due no doubt to the fact that lupus patients now begin treatment at an earlier stage. The treatment with the Finsen light caused electric conjunctivitis in four patients and four nurses, and in one case a mild marginal keratitis. The keratitis was usually of a phlyctenular nature. In twenty-one cases there was pannus. Recurrences were frequent, while the facial lupus remained uncured.

DALÉN.

NATANSON (422) adds another to the cases called by Pick retinitis cachecticorum. Pick observed in 60 to 70% of patients with carcinoma of the stomach or liver the existence of retinal patches and hemorrhages, which, however, caused no disturbances of vision. Natanson regards this clinical picture as analogous to that caused by pernicious anæmia.

COLLOMB and MÜLLER (423) report the case of a woman with puerperal fever after a miscarriage in the third month. There were metastatic abscesses in the left arm and chorio-retinitis in the left eye. The latter apparently had begun in the retina. The condition of the eye improved and a certain amount of vision was retained. BERGER.

ASMUS (424) reports thirteen cases of sclero-keratitis rheumatica which he observed. He believes that Pfalz's sclero-keratitis presents a characteristic picture, consisting in a localized porcelain-like opacity of the parenchyma of the cornea usually parallel to the corneal margin. Salicylate of soda is a specific for this condition.

ROGMAN (425) reports two cases of intraocular tuberculosis in which enucleation of the eye was followed by tuberculosis of the lungs or meninges. The author finds nine other cases in the literature. He believes that the enucleation may hasten the outbreak of tuberculosis in other parts, and that in primary tuberculosis of the eye (whose existence, however, is denied by Leber, Fuchs, and Baumgarten) exenteration of the orbit is preferable to enucleation. BERGER.

MORAX (426) examined a number of hospital patients with measles, and in no case found the corneal affection described by Trantas. He found frequently, however, the common blepharo-

conjunctivitis morbillosa, which lasts from one to nine days. Besides this, there were mixed cases with added infection by the Weeks or Pfeiffer influenza bacillus. BERGER.

JANET (427) observed peculiar disturbances of vision in an hysterical woman of sixty-five with retinal hemorrhages, which, in the left eye, led to complete blindness. Since this eye was painful and phosphenes existed, Valude cut the optic nerve. This operation led to divergent strabismus of the left eye and to the following symptoms: Whenever the patient began to read, a cloud appeared in the left side of the field, and became so pronounced finally that objects in the room could not be recognized and vertigo and nausea came on. Janet believes that in hysteria there are two sorts of disturbance of binocular vision. In one sort, binocular fusion of the visual impressions is impossible, and that of one eye is psychically suppressed. In the other sort there is an increase of binocular association, and notwithstanding the blinding of one eye the patient persists in attempting the impossible binocular vision, whereby the sense of the lack of convergence and accommodation in the left eye disturbs the fixation and accommodation of the right and brings about the disturbances here described. BERGER.

LECHNER'S (428) patient was a boy of thirteen who, although otherwise normally developed and bright, had never been able to learn to read. The eyes were normal. He recognized figures and Snellen's books, and was not backward in arithmetic. The cause of the congenital word-blindness must be sought for, according to the writer, in the region of the angular and supramarginal gyri, and consists in an arrest of development. When this condition is recognized early the patient may be spared much humiliation.

SCHOUTE (429) finds that cases of cinchonin poisoning are not recorded, and hence patients who have had quinine poisoning may more safely take cinchonin. He saw, however, one woman of forty who always exhibited signs of general poisoning after taking quinine, and after taking one gramme of cinchonin a mild paresis of accommodation and of the sphincter appeared. The retina was not affected as in quinine poisoning. JITTA.

DODD and MCMULLEN (430) describe the case of a child aged seven years who presented an oxycephalic skull with marked proptosis, post-neuritic atrophy, defective hearing, and several

other deformities. The pathology of the case is discussed and references are given to several other analogous cases.

MARSHALL.

ZIMMERMANN and PUSEY (431) describe the case of a child which had lost one eye from metastatic irido-choroiditis following meningitis when about one year old. Thirteen years after, the patient was attacked with symptoms of meningitis and the eye was found congested, chemotic, and painful, especially to touch. There were also symptoms of sympathetic irritation in the other eye; pain, photophobia, redness. On enucleation, all unfavorable symptoms disappeared. The microscopic examination showed the signs of an old inflammatory process, such as connective tissue and bone formation, and in addition the evidences of an acute process involving the whole eyeball and some of the cellular tissue back of it. The optic nerve and sheath were free from acute inflammation. The presumption is that the acute process starting in the phthisical eye travelled backward to the brain by way of the ciliary nerves, which were found broken up and surrounded by acute inflammatory changes.

ALLING.

GILFILLAN (432) saw a case of panophthalmitis beginning on the twenty-sixth day during the course of typhoid fever. The sight of the eye had been lost seventeen years before from an injury, but he sees no connection between this fact and the occurrence of the infective process. ALLING.

During a recent epidemic of small-pox of severe type in Cleveland, BAKER (433) saw twenty-three cases of serious eye complications. Eight eyes were either enucleated or atrophied, six patients were left blind in one eye, three had vision less than $\frac{20}{200}$, and not more than five had vision better than $\frac{20}{200}$. Two had corneal fistulæ. The lesions were ulcers of the cornea complicated by irido-cyclitis or panophthalmitis. Streptococcus was found in every case. Occasionally a mixed infection with staphylococcus was present. The onset of the eye trouble was usually after the twelfth day. ALLING.

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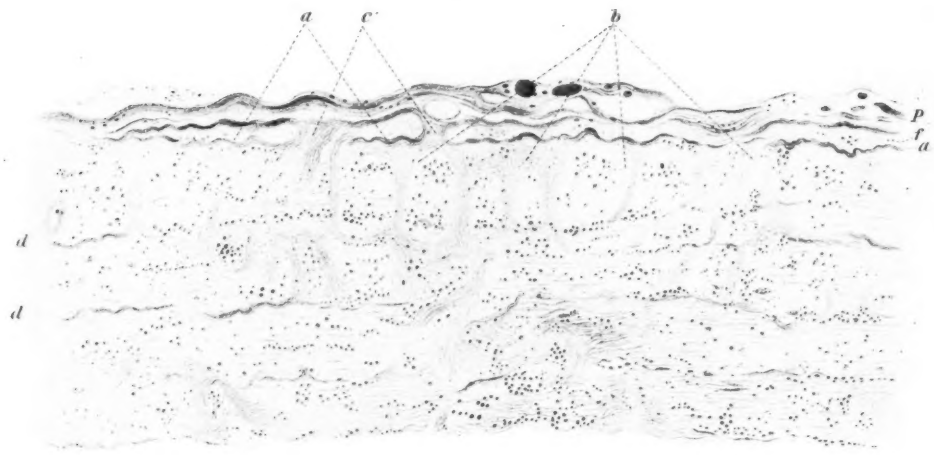

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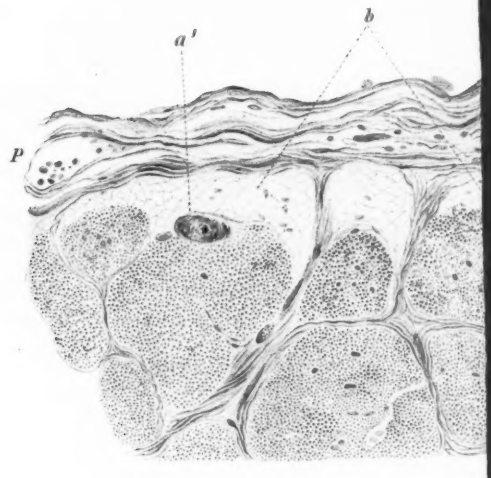

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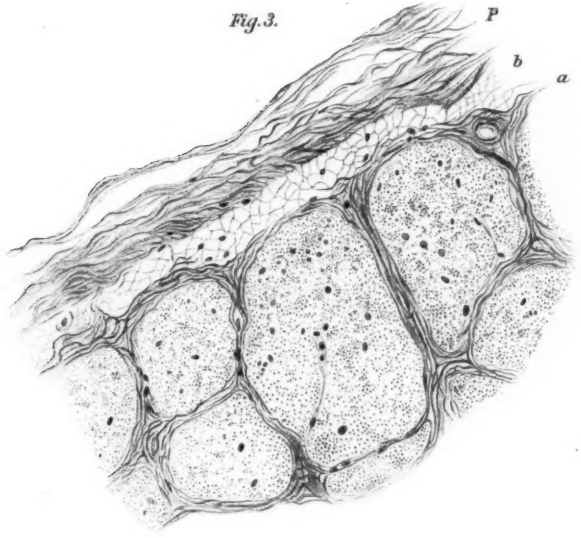

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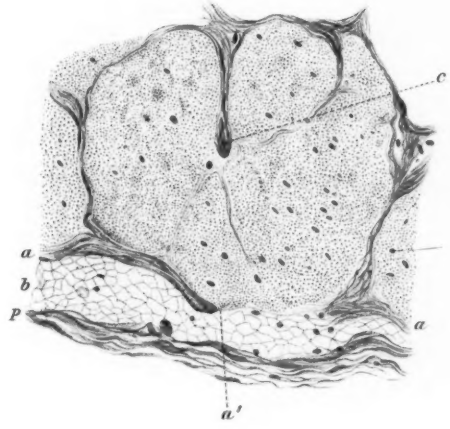

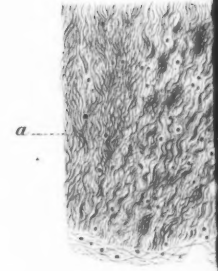

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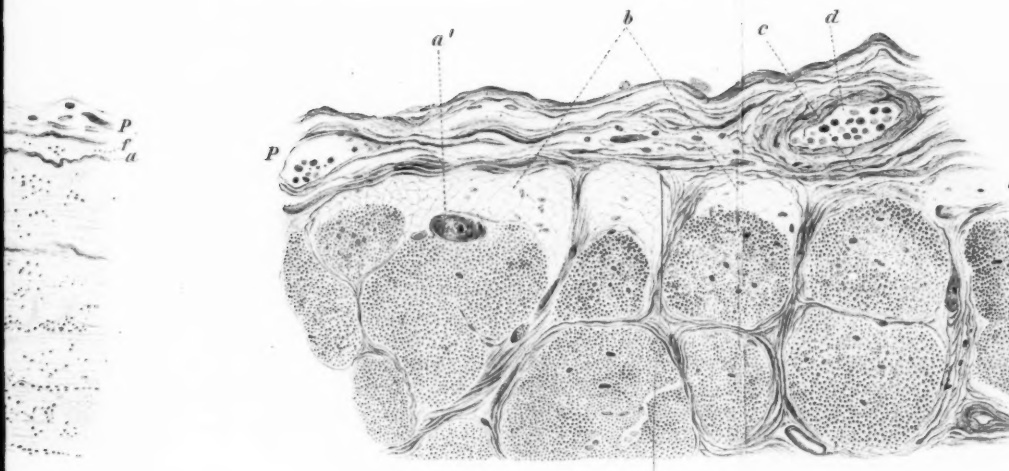

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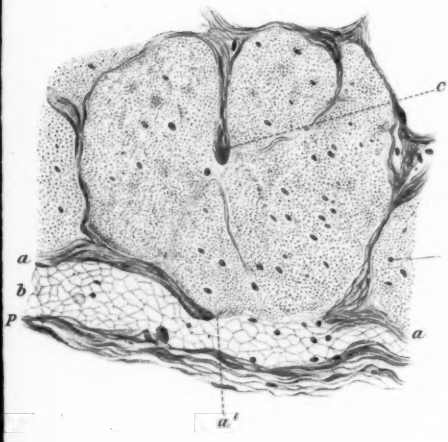

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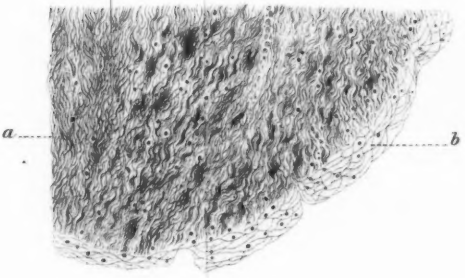

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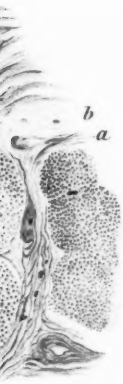

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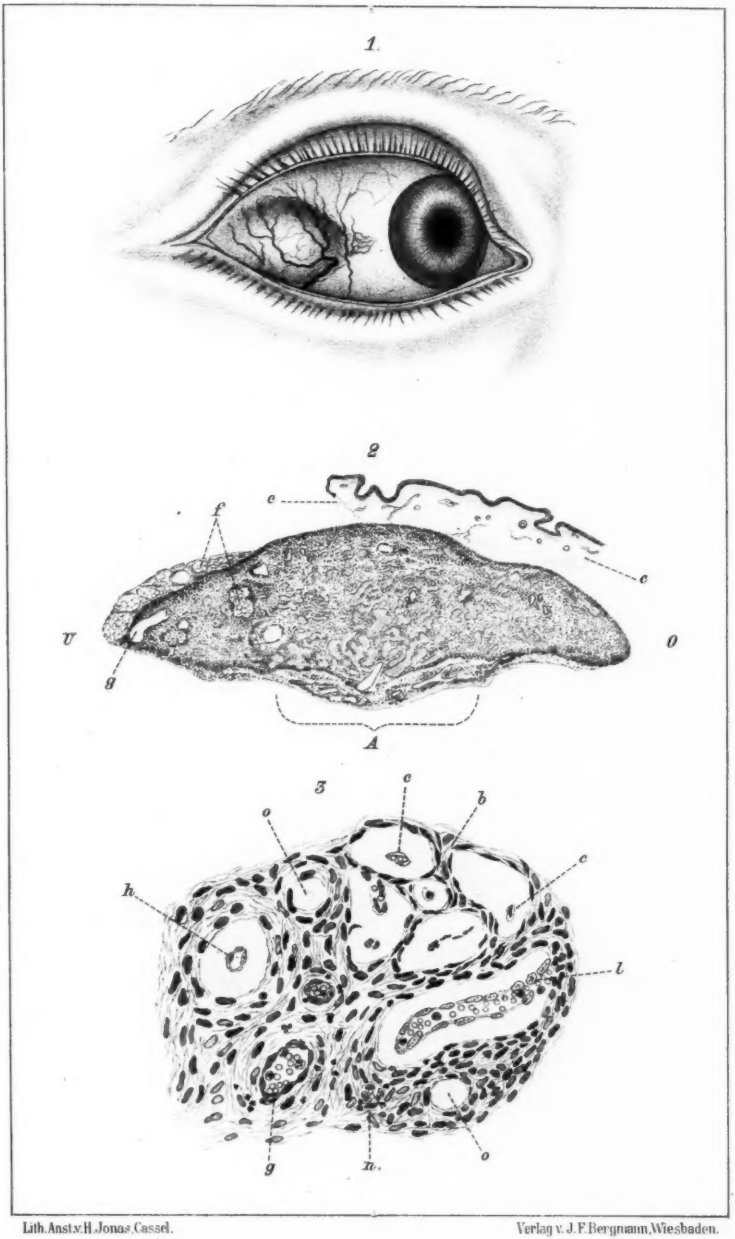

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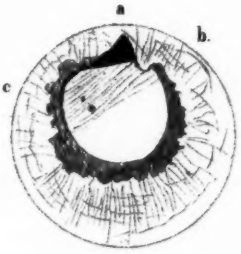

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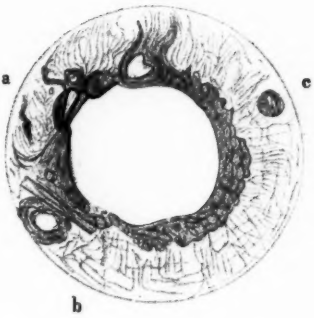

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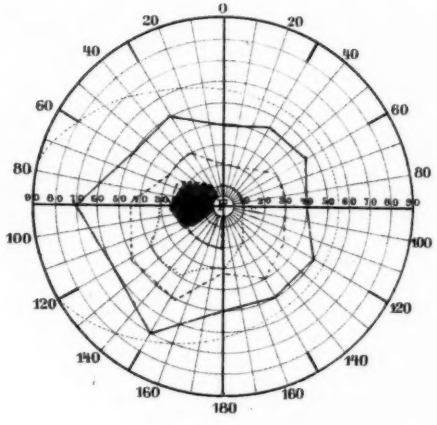

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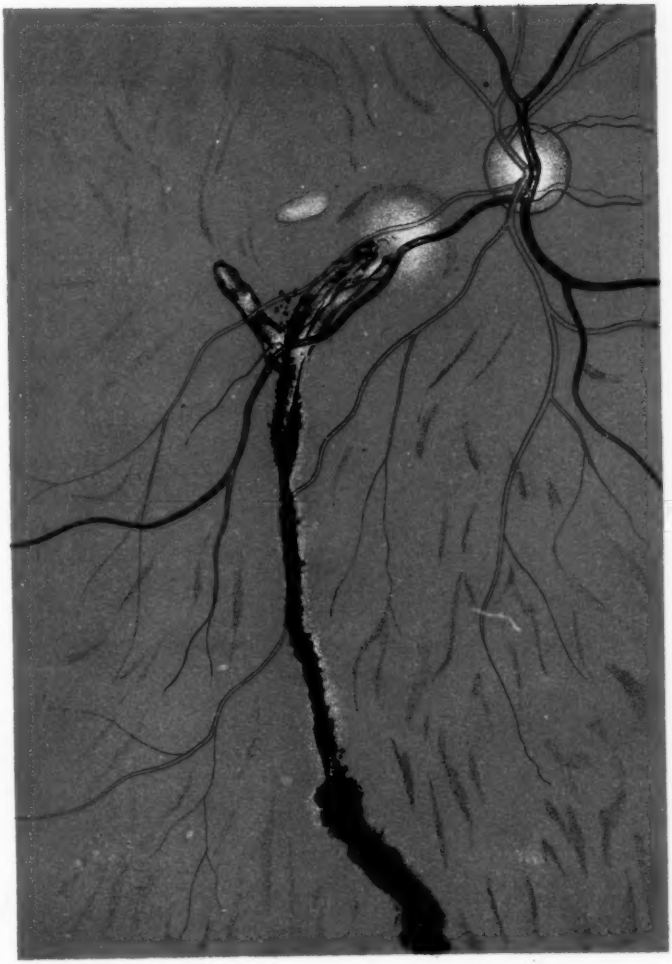

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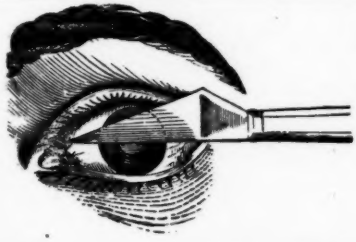

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